

DEPARTMENT OF THE INTERIOR

ANNUAL REPORT

OF THE

TOPOGRAPHICAL SURVEYS
BRANCH

1913-14

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OTTAWA

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REPORT
OF THE
SURVEYOR GENERAL OF DOMINION LANDS
1913-14

DEPARTMENT OF THE INTERIOR,
TOPOGRAPHICAL SURVEYS BRANCH,
OTTAWA, August 7, 1914.

The Deputy Minister of the Interior,
Ottawa.

SIR,—I have the honour to submit the following report of the Topographical Surveys Branch for the year ended March 31, 1914.

The survey operations in the field were continued on about the same scale as during the previous year. The surveys carried out under the direction of this branch may be dealt with under the following heads: block outlines, township subdivision, inspection of contracts, delimitation of interprovincial boundary, levels, topographical work, stadia traverses, corrections and resurveys, settlement and townsite surveys, timber berth and mineral claim surveys, Yukon surveys.

BLOCK OUTLINES.

The unsurveyed portions of the provinces of Manitoba, Saskatchewan, and Alberta are wooded lands interspersed with extensive marshes, with here and there tracts of good land. Except along the main waterways and the surveyed lines of the Dominion lands system, this country is practically unknown. It is certain that much of the land is unsuitable for occupation, but with a view to the subdivision of the scattered tracts of good land as they are required for settlement, the efforts of the department have been directed towards the extension of the system of base lines and meridian outlines upon which the system of Dominion lands surveys is built up.

The tide of settlement in recent years has set strongly towards the Peace River district. Extending northerly from this district, the Peace and Athabaska rivers afford two natural highways along which the pioneers of future settlement will naturally proceed. There is already a persistent demand for surveys at Fort Vermilion and McMurray.

The meridian outline between ranges 17 and 18, west of the fifth meridian was surveyed northerly from the twenty-third base to the twenty-eighth base. From this meridian outline the intervening base lines were run across the valley of Peace river, thus enabling the department to proceed with the subdivision of lands along the valley as they are required.

Between the fourth and fifth meridians the twenty-fourth and twenty-fifth base lines were run westerly across the valley of the Athabaska. The survey of the twenty-first and twenty-second bases between these two meridians was also completed.

West of the Athabaska and south of McMurray the country is very wet, large muskegs extending back from the river as far as range 23. These muskegs as a rule can be easily drained, and when dry will make excellent agricultural lands. Extensive

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areas of good farming land lie along the valley of Wabiskaw river, which flows northerly in the vicinity of the fifth meridian, and empties into the Peace near Fort Vermilion. Fire has swept a great part of this north country, leaving only small patches of good timber here and there in the muskegs.

The district north of McMurray is not suited for farming on account of the muskegs and summer frosts, but ranching can be carried on successfully.

The sixteenth base line was run from the second to the third meridian, and the nineteenth base west of the third meridian across nineteen ranges. The production of these base lines was necessary to enable the department to subdivide lands to meet the needs of the scattered settlements in these districts. Exceptional difficulties were met with by the survey parties in both cases due to the extensive swamps encountered, and to the lack of horse feed along the base lines. The soil all through the country is good, but extensive drainage operations will have to be completed before much of the land can be used for agricultural purposes. Jackpine is the prevailing timber, but some areas of spruce up to thirty inches in diameter were seen.

The construction of the Hudson Bay railway, which is now under way, has created a demand for the survey of lands along the route. To meet this demand a network of base and meridian outlines had to be established north of lake Winnipeg.

The principal meridian was run north from the nineteenth to the twenty-first base line, and the twentieth and twenty-first base lines were run east a few ranges from the meridian, and the twentieth base line three ranges west of the meridian. The seventeenth, eighteenth, and nineteenth base lines were projected westerly from the principal meridian across the Hudson Bay railway, and the sixteenth base line was run from range 26, west of the principal meridian, to the second meridian.

The land along the principal meridian is mostly dry and rolling, and much of it is fit for agriculture. Along some of the lines surveyed, swamps prevail, the soil being mostly clay covered with moss. Timber as a rule is stunted, but occasional belts of jackpine and spruce up to twenty-six inches are found. Water-powers exist on all the streams, and fish abound in the lakes. -Fishing will be a very profitable industry when the markets are made available by the completion of the railway.

The second meridian was extended northerly from township 78 to township 85. Little of the land along this part of the meridian is fit for agriculture, the soil being mostly sandy, with frequent outcroppings of rock. A few good areas, however, lie along Churchill river.

The proposal to extend a railway northerly between lakes Winnipeg and Winnipegosis towards Grand Rapids, and the demand for lands in the vicinity of this settlement, make it necessary to establish the base lines between the lakes. The thirteenth and fourteenth base lines were, last season, produced as far easterly as the shore of lake Winnipeg, and it is proposed to complete the survey of the remaining base lines the coming season.

TOWNSHIP SUBDIVISION.

Subdivision surveys were made under contract mostly in the Peace River district and between Athabaska (formerly Athabaska Landing) and Lesser Slave lake. The projection of railways throughout these districts has stimulated settlement, and extensive subdivision surveys were necessary to keep ahead of the demand for land.

The reports received from the surveyors indicate as a rule that these lands are good for agricultural purposes. They are mostly heavily timbered, but this will not greatly retard settlement, as all the prairie lands of Western Canada are already subdivided, and to a great extent alienated.

A number of townships were subdivided along Athabaska river north of Athabaska to meet the requirements of settlement extending northerly along the valley. A few townships north of Battleford, and a small number near lake Winnipegosis and east

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of lake Winnipeg were also surveyed. In all, twenty-seven parties were employed on contract subdivision. Subdivision surveys, of such a nature that they could not conveniently be executed under contract at the regular rates fixed by Order in Council, were made in the foot-hills of the Rocky mountains in southern Alberta. All the land lying east of the Rocky Mountains Forest reserve was also subdivided. These surveys were undertaken to meet the demand of farmers and ranchers for land in the foot-hills and in the valleys penetrating the mountains.

Several townships or portions of townships in the vicinity of Fort Vermilion were subdivided. Some excellent prairie land lies in that locality, and settlement there is rapidly increasing. Squatters had been on the land for years, and were urgently asking that the lands be subdivided so that their claims might receive consideration before the influx of settlers caused complications.

The country bordering the southern section of the Hudson Bay railway consists of narrow ridges separated by wide areas of swamp and muskeg, and is not suitable for subdivision in block. It is essential, however, that a few sections on each side of the right of way shall be laid out, and during the past season, the work was carried on as far north as the sixteenth base line. A number of unsurveyed fractional townships around the Porcupine Forest reserve were also completed.

In the railway belt, British Columbia, seven parties were employed on township subdivision. The work was mostly in compliance with the demands of the Dominion lands agents and the settlers. Lands along the right of way of the Canadian Northern and Canadian Pacific railways were subdivided. Township subdivision in British Columbia includes in many cases, the survey of timber berths, village and town lots, and the retracement of Indian reserves and provincial lot boundaries. Owing to the mountainous character of the country the surveys are not suitable for execution under contract. In the Revelstoke and New Westminster districts, land is so valuable that it is usually allotted to settlers in 40-acre parcels. To mark the boundaries of such parcels sufficiently involves several miles of additional survey in each township. Land along the Fraser is excellent for fruit farming, and this industry is making rapid strides, though the lack of transportation is a great drawback.

By an Act of the Legislature of British Columbia, passed in 1883, the province granted the Dominion three and one-half million acres of land lying east of the Rocky mountains and adjoining the Northwest Territories. The boundaries of the block were surveyed a few years ago. On account of the excellent land in the block and the prospect of railway construction across it in the near future, settlers are flocking to the district. To meet the requirements of the newcomers, subdivision surveys are required of the prairie openings here and there. Several hundred quarter-sections were surveyed last season, and the fact that lands are available in that fertile district will no doubt stimulate settlement.

INSPECTION OF CONTRACT SURVEYS.

Subdivision surveys performed under contract during the year were examined by five inspectors. Their reports indicate that contractors have generally performed their surveys in fair conformity with the provisions of the Manual of Survey, and of their contracts with the department.

INTERPROVINCIAL BOUNDARY SURVEYS.

The boundary between the provinces of British Columbia and Alberta follows the Rocky mountains from the international boundary to the 120th meridian; thence it runs due north along this meridian to the 60th parallel of latitude.

At the request of the province of British Columbia arrangements were made for the delimitation of this boundary as a joint survey under Mr. A. O. Wheeler, B.C.L.S., Mr. R. W. Cautley, A.L.S., and Mr. J. N. Wallace, D.L.S., representing the provinces of

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British Columbia and Alberta, and the Dominion, respectively. The survey was begun last year in the vicinity of the main passes. The line was established and marked across Kicking Horse pass, Vermilion pass, Simpson pass, and Crowsnest pass. Pyramids of concrete, two feet high and covered by galvanized iron, were erected to mark the boundary where surveyed. Above timber-line, stone cairns five to seven feet high were substituted for the cement pyramids.

LEVELS.

Five thousand three hundred miles of line have now been levelled by surveyors of meridian outlines and base lines in the western provinces. As a result, much information previously lacking is now available for dealing with future extensions of railways, utilization of water-powers, improvement of navigable rivers, drainage, and development of natural resources. The results show that many areas of wet land, reputed to be of little value, can be drained readily into neighbouring streams, and become fit for agriculture. These lines of levels, having been commenced in unsettled lands where no altitudes were previously known, are dependent on the running of other lines for their connection to sea-level, and to one another. Twelve hundred miles of these connecting lines have already been run. These have joined the greater part of the levels to sea-level, thus improving their accuracy, and have furnished new information for the partly settled lands. The results are now being tabulated and will be published shortly.

TOPOGRAPHICAL SURVEYS.

At the request of the Director of Forestry, a topographical survey of the Crowsnest Forest reserve on the eastern slope of the Rocky mountains was begun last season. It is expected that the map of the reserve, when published, and the data collected by the survey, will be of great benefit, not only to the Forestry Branch, but also to the numerous holders of oil, coal, timber, and mineral claims.

In 1886 and 1888 a topographical survey was made of the country in the vicinity of Banff, Alberta. A scheme of lots was prepared in conformity with the topography, but only a few of the corners were marked. Mr. Mawson, an expert on town planning, has been engaged on the amended scheme for the subdivision. The villa-lot section and the townsite at Banff have been retraced. Roads have also been located, and scattered surveys made throughout the Rocky Mountains park.

In 1913 part of the townsite of Jasper in Jasper park was surveyed. A topographical survey of the surrounding country was commenced in order to obtain information for the preparation of a suitable scheme for the development of the park. The work is being continued this year.

STADIA SURVEYS.

Eight parties were employed in the prairie regions on stadia surveys of lakes and ponds that have been gradually drying up, and of rivers that have changed their courses. These surveys were undertaken for the purpose of amending the official plans of the townships so that they may represent all lakes, ponds, and rivers as they are at the present date, and give the correct area of land available.

A party on stadia surveys consists of a Dominion Land surveyor in charge, a surveyor's pupil, two rodmen, and a cook. A district is assigned to each party, and they are expected to investigate and report upon all bodies of water over five acres in extent in each township in which they carry on operations. If a body of water is over five feet deep, or if it does not dry up in the fall, the banks are traversed and a plot thereof forwarded to the head office. Rivers over a chain wide, and all islands, are accurately surveyed.

To avoid delay in issuing amended official plans, the surveyor is required to plot his traverse in camp and send it to the head office at the earliest opportunity. The sur-

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Surveyor is provided with special field books suitable for field notes of stadia surveys, and with convenient portfolios containing paper and drawing board for making traverse plots. Complete detailed instructions for making stadia surveys, for keeping field notes, and for preparing plots have been printed and furnished to each surveyor.

The eight parties employed last season made traverses or investigations in 442 townships; 3,360 miles of traverse were run.

CORRECTION AND RESURVEYS.

Some of the early surveys in the western provinces were badly executed; lines which are shown on the official plans as running north and south or east and west are found to be very much out in direction, and quarter-sections returned as 160 acres each are sometimes more than 40 acres over or under the area returned by the surveyor. When authorized by the provisions of the Dominion Lands Surveys Act, corrections are made by our surveyors. Last year two surveyors were employed to travel from place to place to make corrections or such small original surveys as could be done by a surveyor and assistant without a party. They made surveys in about seventy townships.

In many townships surveyed twenty-five or thirty years ago not a trace can be found of the original survey. Where the marks have disappeared it is difficult for newcomers to locate the lands. It is the policy of the department to renew the lines in townships now being colonized after an investigation has shown that it is impossible to locate the lands without a new survey. Three parties were employed on resurvey work during the past season.

Base lines and initial meridians run many years ago are also found to have been badly surveyed. These lines being the governing lines of the Dominion lands system it is very necessary that their survey be accurate and reliable. To determine the nature and extent of some of the discrepancies, the retracement of the old base lines and meridians was commenced in 1912. In 1913 the second base line was retraced from the principal to the second meridian, as well as other lines in Manitoba and Saskatchewan. In 450 miles of line retraced the five largest errors found were of twenty-seven chains, seventeen chains, eight chains and eleven chains. The error of twenty-seven chains was made in measuring distance, but the remaining four were errors in direction.

SETTLEMENT AND TOWNSITE SURVEYS.

In the summers of 1911 and 1912 a survey party was engaged in surveying settlements along the Athabaska and Slave rivers. The work was continued during 1913, and the surveyor in charge will remain in the field till the autumn of 1914. It is expected that the survey of all the settlements along these rivers will be finished by that time.

A settlement was also surveyed at Wabiskaw, Alberta, and a summer resort at Wymark, Saskatchewan.

TIMBER BERTHS.

Under the present regulations the surveys of timber berths are made by the department before the berths are offered for sale. The cost of the surveys is included in the upset prices of the berths. The berths are surveyed by surveyors working under contract, or by the surveyors employed regularly during the season under daily pay, as may seem most economical. Fifty-two miles of timber berth boundaries were surveyed in 1913.

MINERAL CLAIMS.

Every mineral claim is designated by a lot number in the group to which such lot belongs. The claimant, after staking his claim, is required to apply to the Surveyor General to have instructions issued to a Dominion land surveyor to have the boundaries of the claim run out, measured, and marked on the ground. Lot and group numbers

for the claim are furnished the surveyor with the instructions for survey. After completing the work on the ground, the surveyor must forward to the Surveyor General a plan of the claim on tracing linen, accompanied by complete field notes. He must furnish as well the necessary duplicates, the plan for filing with the mining recorder and for posting on the claim.

Twenty-two mineral claims outside of the Yukon Territory were surveyed last season. Thirty-one additional were surveyed in the Yukon Territory. In the latter district the group and lot numbers are furnished to the surveyor by the Commissioner of the Yukon, and the returns of the survey must be filed with the commissioner.

YUKON SURVEYS.

Dominion land surveys in the Yukon Territory are under the direction of a Director of Surveys who has his office at Dawson; he has a staff of two draughtsmen. The work is mostly in connection with mining claims.

During the year 167 miles of base lines and connecting traverses were made along The work is mostly in connection with mining claims.

STATEMENT OF MILEAGE SURVEYED.

The following is a comparison of the mileage surveyed each year since 1911:—

Nature of Survey.	April 1, 1911, to March 31, 1912	April 1, 1912, to March 31, 1913.	April 1, 1913, to March 31, 1914.
	Miles.	Miles.	Miles.
Township outlines	2,041	2,718	3,760
Section lines	19,098	10,365	7,918
Traverse	2,577	3,500	5,748
Resurvey	2,317	2,586	1,632
Total for season	17,033	19,178	19,058
Number of parties	61	72	66
Average miles per party	280	266	289

The following tables show the mileage surveyed by the parties under daily pay, and by the parties under contract:—

WORK OF PARTIES UNDER DAILY PAY.

Nature of Survey.	April 1, 1911, to March 31, 1912.	April 1, 1912, to March 31, 1913.	April 1, 1913, to March 31, 1914.
	Miles.	Miles.	Miles.
Township outlines	992	1,619	2,074
Section lines	823	1,358	1,695
Traverse	498	992	1,172
Resurvey	2,237	2,538	1,613
Total for season	4,550	6,507	9,561
Number of parties	29	35	39
Average miles per party	157	186	245

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WORK OF PARTIES UNDER CONTRACT.

Nature of Survey.	April 1, 1911, to March 31, 1912.	April 1, 1912, to March 31, 1913.	April 1, 1913, to March 31, 1914.
	Miles.	Miles.	Miles.
Township outlines	1,049	1,099	1,605
Section lines	9,275	9,077	6,214
Traverse	2,979	2,747	1,560
Resurvey	80	48	19
Total for season	12,483	12,671	9,497
Number of parties	32	37	27
Average miles per party	390	342	352

Owing to the nature of their work, twelve parties are not included in the statement of mileage for the year ended March 31, 1914.

COST OF SURVEYS.

The following statement shows the average cost per mile of surveys executed by surveyors under daily pay, and by surveyors under contract:—

	Surveyors under daily pay.	Surveyors under contract.
Total mileage surveyed.	9,561	9,497
Total cost	\$542,297	\$278,707
Average cost per mile.	\$56.72	\$29.35

CONTRACT SURVEYS.

Section 53 of the Dominion Lands Surveys Act provides that the township subdivision survey of Dominion lands shall be performed under contract, either at a rate per township, per mile, or per acre, to be fixed, from time to time, by the Governor in Council, or by competitive tender, as the Governor may, from time to time, direct; provided that in special cases, where circumstances render it advisable, the Governor in Council may order the survey of a township or townships to be otherwise performed.

In my opinion the time has come to abandon the system of contract surveys and to have the subdivision surveys of the Dominion executed by surveyors and parties paid by the day.

The system of Dominion land surveys is an adaptation of the United States system. The method of surveying under contract was one of the features borrowed from the United States; it had several advantages and as land had little value, it was believed that the imperfection of the surveys was of small consequence. The system was cheap and, as little or no inspection was made, it gave no trouble for the time being. Surveyors were ready to undertake surveys for almost any remuneration. At one time, tenders were called; the rates asked by the surveyors were so absurdly

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low that they have since been fixed by Order in Council at a figure sufficient for doing the work irrespective of what the surveyors would be ready to accept. A consideration which had great weight when a rush of immigration set in was that the amount of surveying which could be performed under the contract system was unlimited. With work paid by the day, the amount was limited by the number of qualified surveyors available; there was no such limitation with contractors.

The objections to surveys made under contract are many. The cost of a subdivision survey cannot be estimated in advance; it depends upon the nature of the ground and upon other circumstances unknown both to the Government and to the contractor, and which cannot be foreseen. No schedule of rates can be devised which will afford fair remuneration to the contractor in all cases without being excessive in any case. A contractor may make large profits if he happens to strike good country and is favoured by circumstances, while another may lose money through no fault of his own, if circumstances are against him. If he is unable to pay the wages of his men or his bills for supplies, the creditors ask payment from the Government and are aggrieved when it is refused.

Before a contractor is paid for a survey, some one should go over the lines in order to make sure that the survey for which payment is asked has actually been made. This inspection is never made for the obvious reason that it costs as much to inspect a survey line as to survey it in the first instance, the inspection involving the same measurements as the survey itself. If all the lines were inspected, the inspector might as well survey them himself and dispense with the survey of the contractor, thus saving the cost of the contract.

In the early days, very little inspection was made; the word of the contractor that the survey had been correctly executed was accepted and he was paid. We are now going over these old surveys; many of them are incorrect. Sometimes we can find no trace of a survey, and it is a question whether the original survey, which was paid for, was ever made.

At present, an inspection is made of a few miles in each contract. If nothing wrong is found, it is assumed that the remainder of the contract has been executed and that the survey is correct, but there is no direct evidence that such is the case.

There are five inspectors and a chief inspector of surveys; the cost of inspection is over \$68,000 a year. The expenditure on contract surveys during the year was about \$240,000, so that the inspection costs more than one-quarter of the work inspected. It is true that the inspectors do some little work besides inspection, but it does not amount to much.

Some surveyors do good work under contract; others do not. When a contractor's work is found defective, he is invited to correct it. He corrects the defects pointed out by the inspector, after which a new inspection is made and new defects are discovered. This may happen again and again, until so many inspections are made that it would have been cheaper for the inspector to make a new survey.

When the survey is very bad, the situation is most embarrassing. The bond given by private sureties for securing the advances does not appear to have much value; we have lost the cases that were brought before the courts. Surety companies are the only ones from whom we have recovered because they prefer paying to being sued by the Government. Practically we have the alternative of accepting bad work or losing our advances.

A large proportion of the appropriation for Dominion land surveys is now being expended in resurveying townships imperfectly subdivided under contract. The lands being settled and occupied, the resurveys are very intricate, unsatisfactory to the settlers, and most expensive. Money would have been saved if the surveys had been properly made in the first instance. For this reason alone, if for no other, the contract system should be abolished.

SESSIONAL PAPER No. 25b

Land has become too valuable for the imperfections of the contract system. The value of one or two acres in a quarter-section represents many times the difference in cost between a good and a bad survey.

After he has finished the survey in the field and received 75 per cent of the amount of the contract, the contractor attends to the preparation and correction of his field notes when he is not otherwise engaged. This is the cause of serious delays; it is seldom less than two years before the township plans are issued and the lands thrown open to settlers.

With competent surveyors and properly organized parties, there is no reason why subdivision surveys paid for by the day should cost much more than if executed under contract. The contract system was discarded in 1910 by the United States. The report of the Commissioner of the General Land Office for 1911 contains the following remarks:—

“June 30, 1911, was the close of the first fiscal year under the direct system, and it is gratifying to be able to report that it has been an unqualified success. When the change in method from the contract to the direct system was first considered, it was expected that the cost of production would not be greater than that in the procedure which it was proposed to abandon. It was conceded that greater expedition would ensue and better work be accomplished, and this alone would have justified the change. The work of last season and this season, however, has shown that the average cost of survey of a township under the direct system is \$750, or a saving of about \$5 per mile, the average cost of surveys under the contract system being \$15 per mile.

“There is, in addition, a saving from one to two years in time, counting from the time of the appropriation to the completion and adoption of the survey.”

Again in his report for 1913, he states:—

“The third season of field operations under the direct system has fully demonstrated the wisdom of abandoning the contract system.”

BOUNDARY MONUMENTS.

The corner of a section or quarter-section is marked by an iron post and four pits, with or without a mound. The mound and pits become obliterated in time, or are wilfully destroyed; the post, which is a 3-foot length of half-inch iron pipe, is easily pulled out. A person who has an interest, for some purpose of his own, in removing land marks, can easily do it, and evidence is not lacking of the destruction of a large number of survey monuments. When the monuments are gone, a new survey must be made and, if the land is alienated, it is a most unsatisfactory and expensive undertaking.

A more substantial boundary post, and one that cannot be so easily removed is very desirable, but the improvement will involve some expense. Not only will the initial cost of the post be greater, but the post will be heavier, and transportation will be expensive. Land has become so valuable and the troubles due to lost corners are so far reaching that the outlay for improving corner marks will prove a wise investment.

CORRESPONDENCE.

The correspondence consisted of: letters received, 13,588; letters sent, 17,000.

ACCOUNTS.

Number of accounts dealt with, 1,616; amount of accounts, \$1,073,655; number of cheques forwarded, 3,651.

OFFICE WORK.

T. Shanks, Assistant Surveyor General.

In previous reports, attention was called to the deplorable condition of the office staff. The situation has not improved; on the contrary, it is becoming worse. Last year twelve permanent technical employees left our service; their names are: J. P. Cordukes, A. S. Thomas, L. O. R. Dozois, G. O. Vogan, T. S. Mills, S. D. Robinson, Jas. Hill, G. N. Clarke, O. E. Fournier, J. J. Freeland, J. A. S. King, L. G. Smith.

Twenty temporary employees were secured through the Civil Service Commission for filling the vacancies. Of these ten left before their period of probation had expired, and before we had a chance of appointing them permanent; their names are: W. B. George, G. B. Stewart, A. H. Bick, L. C. Prittie, G. A. George, J. Mooney, A. J. Boucher, L. Leclerc, H. S. Van Patter, R. J. Gauley.

Comments are superfluous. Employees do not abandon their positions in such large numbers unless there is something radically wrong in the conditions of their employment. This has been going on for years. The disastrous consequences of this policy are set forth in last year's report; I can only repeat that efficient administration with a staff continually changing is not to be thought of.

As an office, our first duty is towards the settler on Dominion lands. It is important that his homestead shall be correctly laid out and marked by proper monuments. While the subdivision of Dominion lands appears to be an operation of extreme simplicity, actual experience has proved that it can be done only by properly qualified men equipped with instruments specially designed for accurate work. Facilities have now been provided in one of the divisions of the office for instruction in special astronomical work, and for the testing and inspection of surveyors' instruments. The results have amply justified the additional attention given to this department of our work.

The preparation of detailed instructions, many of technical nature, covering the work of a field staff of seventy or eighty surveyors, requires the services of men who are thoroughly conversant with survey methods, and with the history and records of the old surveys. Unfortunately, few of our staff have been in the service long enough to acquire these qualifications.

Experience has shown that better results have been obtained by a separation of the draughting offices from the other technical work of the branch. The number of properly qualified draughtsmen looking for positions is very small, and there is great difficulty in getting competent men for the salaries offered. Many of the best technical men are poor draughtsmen and, on the other hand, very few of the expert draughtsmen are qualified for the examination of survey returns, the checking of astronomical data, and the compilation of topographical and geographical information. It has proved a decided advantage to have the compilation of maps and plans prepared by men possessing technical qualifications for the purpose, and to have the draughting done by others specially trained for that work.

It is desirable that the surveys shall be confirmed, and the plans thereof issued as soon as possible after the field work is completed. Delays lead to misunderstandings between the settler and the department, and it is frequently a matter of surprise to the former that it is not possible for him to secure patent as soon as the lines are marked on the ground. Where the matter is particularly urgent the surveyor is instructed to forward returns from the field as soon as the survey is completed, but this can be done in comparatively few cases without seriously interfering with the field work. The cost of a party in the field is so great that it is not advisable to keep the surveyor employed on clerical work which, under ordinary circumstances, can be much better done in an office where there are proper conveniences for the purpose, and without keeping the party idle.

SESSIONAL PAPER No. 25b

Inquiries from the general public for information as to the localities covered by subdivision or exploration surveys are being received in increased numbers. An attempt is made to print the surveyors' descriptive reports as soon as possible after they are received. The results are not entirely satisfactory as the subdivision reports are not forwarded by the surveyor until the season's work is completed, and the delays in compilation and printing are sufficient to considerably impair the freshness and value of the reports when issued. Little has been done to prepare for publication the reports covering the districts into which subdivision has not been extended, although in many cases these localities have been fairly well covered by the explorers who are now attached to block outline parties. The sketch maps showing the exploration and the general report of the surveyor in charge of the party are published in the annual report of the branch. This information, however, is not in convenient form for reference, as it can be obtained for any particular district only by searching the reports for several years. With additional office help it should be possible to compile much valuable information in such a form as to be of the greatest value to the public. A start has been made in this respect by issuing a pamphlet covering the Peace River district. The demand for this publication indicates the need for further work along the same lines.

DIVISION OF SURVEY INSTRUCTIONS AND GENERAL INFORMATION.

(H. G. Barber, Chief of Division.)

The work of this division consists, in general, of the preparation of instructions for the surveyors who are engaged in the field operations, the entering of all survey returns in the various registers, the issuing of all preliminary plans except for the townships in the railway belt of British Columbia, the compilation of the annual report of the branch, and the answering of requests for information received from the general public and from other branches and departments.

During the year the total number of draft letters and memoranda was 8,293, an increase of more than 30 per cent over the preceding year.

Two hundred and ninety-five drafts of instructions to surveyors for the execution of surveys were issued, involving the preparation of 2,628 sketches and 234 maps and tracings.

Two thousand and seventy-eight communications from settlers and others, and inquiries from other branches and departments were dealt with, an increase of more than 40 per cent over the number during the preceding year. This necessitated the preparation of 588 sketches, 92 maps and plans, and 386 pages of field notes. Three thousand one hundred and sixty-one sketches were also made for the information of other branches.

Twelve descriptions of parcels of land were drafted, and a number were checked and revised for other branches.

Preliminary plans were issued for 316 townships. These plans allow of the land being opened for entry at once without waiting for the final examination of the surveyors' returns and the issue of the official plans.

Plans of 672 townships and of thirteen townsites or settlements were received from the lithographic office, entered in the various registers and distributed. One hundred and eight sectional maps and 151 miscellaneous plans were also received and distributed.

During the year there were received from the surveyors in the field, and entered in the office registers, 1,304 progress sketches, 368 books of field notes for township surveys, 414 books and 762 plans for miscellaneous surveys, 219 timber reports, 107 statutory declarations, and returns for 125 magnetic observations, 90 azimuth observations, and for 11 timber berths. General reports on their survey operations were received from all the surveyors under daily pay.

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Their examination having been completed, 456 field books of township surveys and 93 books and 105 plans of miscellaneous surveys were placed on record.

For reference in the work of the office, there were received from the Survey Records Branch, 5,480 field books and 630 plans, and from the Registration Branch, 1,734 files.

Two new publications were issued, namely, the new edition of the Manual of Instructions for the survey of Dominion Lands, and the second edition of the pamphlet entitled "Description of the surveyed townships in the Peace River district in the provinces of Alberta and British Columbia." Already nearly two thousand of the latter publication have been distributed.

A new kind of work was commenced in 1911-12 in the preparation of topographical maps of Banff, Woodhaven, and Jasper (Fitzhugh) townsites, and of Bankhead cemetery, on which schemes of subdivision were laid down, and from which working plans for the surveyors were prepared. This work was continued during the year just passed and, in addition, similar maps and plans were prepared for summer resorts in Madge, Clear, and Elk lakes. A new and comprehensive scheme of subdivision for Banff and its vicinity is now under consideration.

DIVISION OF EXAMINATION OF SURVEYS.

(T. S. Nash, Chief of Division.)

The work of this division comprises the returns of survey of all Dominion lands other than those in the railway belt in British Columbia.

The first returns received from the surveyor are sketches showing the progress of his work. These sketches are examined to see that correct methods are being employed and that satisfactory results are being obtained, 304 progress sketches from contractors, 533 from men employed by the day, and 149 from inspectors of contract surveys were examined, making a total of 986 sketches.

Following the change in the method of dealing with water areas in the prairie provinces, outlined in the last annual report, eight surveyors were employed during this year in the investigation and retraverse of lakes and former lake-beds. This retraverse of lakes by stadia added materially to the work of this division. As this branch of work was new, and the instructions to surveyors were of a tentative nature, it was necessary to examine the returns of survey as soon as received with a view to the revision of the instructions in order to get the most desirable results. As the examination progressed, a comparative analysis of the results was made in order to arrive at a working basis for showing the new land areas and water areas on township plans. One hundred and thirteen field books and 789 plots comprised the final returns of survey of the lakes in 458 townships. The examination of these, together with the preparation of the new township plans, involved so much additional work that it was necessary to employ six of the stadia surveyors after quitting the field.

Including these stadia surveys, examination has been made of 704 subdivision surveys, 95 miscellaneous, and 243 township outlines. Four hundred and three memoranda on examination of survey returns were sent to surveyors and 407 replies were received and the necessary corrections made. Compiled plans of 549 townships were completed, of which 241 were first editions. Compiled plans of thirty-six miscellaneous surveys, twelve settlements and six timber berths were also completed. The number of draft letters prepared was 1,850. Forty-three accounts for contract surveys were prepared and closed, as the work was shown by the inspectors' reports to be satisfactorily performed.

The new plan of the town of Banff was completed, and considerable time was spent on the compilation of surveys in the adjoining villa-lot district.

SESSIONAL PAPER No. 25b

With regard to the maps of the Yukon Territory, one sheet has been completed, and ten are practically finished, having been held up awaiting a further tie between existing surveys. These latter sheets are south of Dawson in the vicinity of the Yukon and Stewart rivers. Twenty group lot surveys, twenty-four base lines and reference traverses in various parts of the territory, and a triangulation survey of part of the lower watershed of Klondike river were received and examined.

Requests for information from other branches of the department involved the writing of 145 memoranda, the preparation of sixty-one sketches and the calculation of 394 areas. The field notes were examined and plans prepared for six timber berths comprising fifteen blocks whose boundaries totalled 140 miles of survey and whose area was approximately 54 square miles. The returns of eighteen other timber berths were examined. The plans of road diversions submitted by the Provincial Governments have been examined to the number of 405. Regarding railways, 110 plans of right of way were examined, the mileage of which was 1,917. As many of these plans were in duplicate or triplicate, the gross mileage of plans examined was equivalent to 4,584. The final returns of twenty-six mineral claims outside of the Yukon Territory were received and examined.

DRAFTING AND PRINTING DIVISION.

(C. Engler, Chief of Division.)

Township Plans.

The preparation of township plans for printing is the most important work of this division. The issue of the preliminary plan of a township allows settlers to initiate proceedings towards obtaining title to their lands, but the title cannot be obtained until the issue of the official plan. It follows that the full value of surveys has not been obtained until such plans have been issued and, consequently, any delay in the issue of the official plan is equivalent to holding back the results and benefits of the survey. It is therefore essential that plans be issued as promptly as possible, and although the work on such plans has become more or less of a routine character, it is to be remembered that they constitute the most important part of our work even though other work may be more inviting and attractive.

The number of township plans prepared for printing was 724. The work on plans of second or subsequent editions is becoming in some respects simpler, in others more complex. As all areas of patented lands are now omitted, the plans have fewer areas, but the notes affecting the plan are more complex.

Plans of Settlements, Townsites, Subdivision and Miscellaneous Surveys.

The number of such plans was seventy. These plans vary in size and scale and, as a rule, require more time to prepare than township plans. In designing them the size, scale, and the arrangement of the notes, north point, border, and margin are subject to the following considerations:—

1. The scale must conform to the requirements of the Manual of Surveys.
2. No sheet can be fed into our lithographic presses larger than $25\frac{1}{2}$ inches by $36\frac{1}{2}$ inches.
3. The top of the plan should be to the north if possible.
4. To prevent waste of paper, plans must, as far as possible, be adapted to the sizes of lithographic paper kept in stock.
5. The arrangement of the borders, notes, etc., of a plan must be such as to reduce to a minimum the number of negatives necessary to reproduce it.

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The first and second of the above considerations are absolute, i.e., the scale of a plan cannot vary beyond certain fixed limits, and the size of the sheet of paper is limited. It follows that when a plan covers a very large area it must be printed in sections and, if necessary, joined afterwards. When plans are to be reduced by photography, the amount of such reduction must also be kept in mind by the draughtsman. On a plan too much reduced, letters and figures become so small as to be illegible, and fine lines become so thin as to be almost indiscernible. To offset this the draughtsman must make his letters and figures large enough and his lines heavy enough so that the reduction will make them just right.

It will be seen from the above that when a plan is to be copied for photographing and printing the proposition confronting the draughtsman is not simply that of making a neat copy. He must do this, of course, but at the same time he must keep in mind the processes and operations through which the plan must subsequently pass, in order to save extra labour and expense in these operations, and to give the best result when printed. This is especially true of plans in several colours.

Plans to accompany Orders in Council.

These plans are usually small and in several colors. As the Orders in Council are bound in a volume eight inches by thirteen inches the plans are printed on paper of this size, if possible. In copying them, care is taken to follow the original as closely as possible, as in many cases the plans deal with matters of which we have no official knowledge, and we have no other guide but the plan itself. To copy the original is not always easy, for originals are often very dim and obscure in some details, and letters and figures are not always clear and unmistakeable. Twenty-five such plans were printed.

Exploration Sketches.

During recent years, surveyors of base lines have furnished sketch maps of explorations of the country twelve miles on each side of the line. These are printed in black, blue, and brown on a scale of six miles to an inch, with an accompanying profile on a scale of 1,000 feet to an inch, and are appended to the annual report of the branch. These maps and profiles give a very good idea of the country.

Mounting Plans.

Plans printed in the early days of our lithographic experience were on a soft paper, well suited for making fine prints but not calculated to stand the wear to which copies for office use are subjected. We now use a much more durable paper (though one harder for the lithographers to print on), and for copies likely to have hard usage we use buckram. The office copies of the early plans, however, are in many cases badly torn, and to remedy this we have them mounted on cotton. We have already mounted 140 plans.

Miscellaneous Work.

This work is very varied in character. One of our draughtsmen was formerly an engraver, and during the year his services were frequently requisitioned for numbering the instruments, tapes, etc., of the Special Surveys Division. The number of tapes and instruments engraved was 500. Seven designs in colour for covers of publications for the Immigration Branch were made from time to time by our artist.

SESSIONAL PAPER No. 25b

The paper used by the lithographers is ordered by this division. Most of it comes from England, but some is made in Canada. It has to be ordered some time in advance as it is not so liable to change its shape or dimensions while being printed if it has been for some time in the same atmospheric conditions which prevail in the press room. Well seasoned paper is especially desirable where maps are in several colours, and the fitting or register of the colours requires to be very accurate.

The indexing and filing of plans of value takes up considerable time. When a plan is returned from the photographer it is filed away so that if more copies are required it has only to be photographed again and printed. It usually happens that changes can be effected without making the whole plan over again. We have now over 5,000 plans of townships and over 300 miscellaneous plans filed for future use. We also have a small library of over a hundred volumes, consisting of catalogues, departmental reports, and text books bearing on our work. The supply of printed sectional maps is also in charge of this division.

Supervision and Proof Reading.

As stated above, the draughtsman must plan his work out to suit the subsequent operations of the photographer and lithographer. This being the case, the draughting room may be looked upon as having an interest in the evolution of a printed plan throughout its whole course. This has become more and more apparent as the work has grown in proportion. It has come to be an established custom to look to this division for information on all matters relating to the progress of a plan towards its final printed form. Proofs of all plans are read here and, if necessary, sent for a second reading to those most concerned in their issue, and instructions are given as to the photographic reduction and details of lithographing.

BRITISH COLUMBIA SURVEYS DIVISION.

(*E. L. Rowan-Legg, Chief of Division.*)

The work of this division has been the preparing of preliminary plans from sketches sent in by surveyors, showing the progress of their work in the field, the examination of surveyors' field notes and plots, the compiling of township and other plans, the comparing of fair copies of township and other plans, and replying to requests for various information.

The work done has been as follows:—

Preliminary plans compiled, 55, and copies made, 275; surveyors' field notes of subdivision surveys examined, 25; plots, 36; of mineral claims, 7; of miscellaneous surveys, 14; township plans compiled, 97; townsite plans compiled, 3; miscellaneous plans compiled, 7; fair copies of compiled plans compared, 85; various plots and sketches made, 267; odd jobs and requests for various information dealt with, 368; draft letters and memoranda written, 667.

For the publication of reports of the surveyors engaged during the last few years in the inspection and classification of the lands in the railway belt, the detailed and general reports were collected and handed over to the Superintendent of British Columbia Lands by whom they are being edited.

For this publication, which is to be issued in pamphlet form in three volumes, maps are being prepared upon which will be shown the classification of the lands inspected, as well as all lands disposed of, timber berths, reserves, and other lands reserved from entry.

Two of these maps, for the first volume, have been compiled. This volume covers the railway belt as far westerly as the fifteenth range, inclusive, west of the sixth meridian.

For each of the two remaining volumes a similar map will be required. These have not yet been undertaken.

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MAPPING DIVISION.

(J. Smith, Chief of Division.)

Part of the staff of this division is engaged solely on mapping, the remainder on compiling pamphlets of information about newly surveyed districts in the western provinces.

The usual work has been continued on sectional maps.

Nine new sheets were compiled and printed, taking in the country adjacent to Dunvegan and Fort St. John, and also along Athabaska river as far north as McMurray.

Twenty-five other sheets were revised and reprinted, most of them being in the more settled parts of the provinces. They show new railways, post-offices, roads, etc. Two of these sheets are in the British Columbia railway belt, covering the country adjacent to Vancouver and to Lytton.

The map to accompany the report on the Peace River country was also revised for a new issue, and a map of part of the railway belt was prepared, to accompany Mr. Bridgland's report on the triangulation of the Rocky mountains.

Among numerous smaller jobs may be mentioned a tracing of the contour map of Banff and vicinity, on a scale of 400 feet to an inch; a map of Eastern Ontario; a map of the Atlantic ocean between Canada and Northern Europe; preparing a new edition of the "Index map"; collecting and compiling information for a new map of Banff and vicinity on a scale of one mile to an inch.

The compilation in pamphlet form of all the "useful and available information regarding the newly surveyed sectional districts in the West as well as the reports of all the surveyors who have worked in these districts, has been carried out.

The material for the publication of four such pamphlets has all been made ready. These pamphlets were not printed owing to the lack of suitable maps to accompany them. A map of the St. Ann sectional district, which is to be used as a sample in the preparation of all sectional maps for these pamphlets, was compiled in this office.

A pamphlet containing the surveyors' reports of the townships surveyed between July, 1911, and July, 1912, was prepared, edited, and published.

The pamphlet containing the surveyors' reports of all townships surveyed between July, 1912, and July, 1913, was prepared and edited, and is now in the hands of the printers.

A great many of the reports on townships which are to be included in the 1914 pamphlet have been typewritten, put in proper form, and made ready for publication.

One member of this division, Mr. John Brigly, died. Mr. Brigly's death, which occurred on March 12 after a short illness, is much regretted. He was in the prime of life, was of steady, vigorous habits, fond of athletic sports, popular amongst his associates, and a good man in the office.

SPECIAL SURVEYS DIVISION.

*(G. Blanchard Dodge, Chief of Division.)**Base Line Surveys.*

An examination is being made of the returns of survey of all base lines and meridians. This has been found necessary for the purpose of checking as nearly as possible the latitudes and longitudes of points and lines in the Dominion lands system and comparing their positions, as found on the ground, with the corresponding theoretical positions. As stated in last year's report, a number of errors of considerable magnitude were discovered in the older surveys in and around Manitoba, these errors being largely due to imperfect facilities in the earlier days of survey for testing surveyors' chains and other instruments. An investigation of all the surveys is therefore being made with the object of locating all such errors and, as far as possible, correcting them.

SESSIONAL PAPER No. 25b

Triangulation Survey.

A reduction has been made of the triangulation of the British Columbia railway belt between the Kootenay and Salmon Arm bases. In order to carry the triangulation over the summit of the Selkirks, it was found necessary, in general, that the stations should be situated on the highest peaks. In some cases the long and hazardous climbs were fraught with considerable danger, and the exposed top of a high mountain peak presents many difficulties to rapid and accurate observing. The weather conditions, also, were all against accurate work, and often a hard climb would be undertaken only to find that the stations on neighbouring peaks were invisible or indistinct, and that good work at that station would necessitate another long climb. Under such conditions it has been extremely gratifying to find that the untiring energy and perseverance of the surveyor has enabled him to maintain a high degree of accuracy throughout the survey.

The survey necessitated the observing of angles from sixty-five stations, the accurate measurement of two bases, each about five miles in length, astronomical observations for latitude and azimuth, and considerable subsidiary triangulation and traverse work. The triangulation network extends over a length of about 160 miles of the Canadian Pacific railway, and embraces an area of approximately 5,000 square miles.

When the last results of the angle and base measurements were received at this office during the early part of the year, an adjustment of the whole survey was commenced. This has now been completed in accordance with the degree of accuracy of the angular measurements, by dividing the triangulation network into sections and adjusting by the method of least squares. It was then found that the length of the Salmon Arm base, as computed through the triangulation from the Kootenay base, differed from its measured length by about six inches. A secondary adjustment was made to correct for this slight discrepancy.

Much minor triangulation and traverse work had also to be reduced to provide ties between triangulation posts and other surveys.

As the object of the triangulation was to replace the meridians and base lines as a basis for Dominion land surveys, it was required to compute the position each station would occupy in the Dominion lands system. To do this, it was necessary to form an estimate of the unknown deflections of the vertical at the points of astronomical observations, and to make corrections for the altitude above sea-level at which the Dominion lands surveys are made. The position of each station in the Dominion lands system was then computed from its latitude and longitude by means of tables IV and X of the Supplement to the Manual.

The elevations of the stations, as determined by the observing of vertical angles, have also been computed and adjusted.

A complete report of the triangulation work and adjustment has been prepared, and is ready now for printing.

Magnetic Survey.

Forty-six surveyors were instructed to observe for magnetic declination, and during the miscellaneous surveys made by R. C. Purser, D.L.S., and G. A. Bennett, D.L.S., observations for magnetic dip and total force were taken at fifty-two stations. The results are given in Appendix 58. The instrumental constants of the dip circles, as determined both at the beginning and at the close of the season's work, show a probable error of less than 0.0001 c.g.s. in each case, from the mean of six observations. At nearly every station a complete set of observations was duplicated and the average range was found to be comparatively small.

The index error of every transit used was determined both at the beginning and at the end of field operations. Every observation for declination has been checked,

reduced to the mean of the month by means of the daily records of the declinometer at Agincourt, and plotted on a large scale map.

Besides the ordinary trough compass, as described in Appendix No. 50 of the annual report of this branch for 1911-12, a telescopic pattern was used this season. The compass was first submitted to the officer in charge of the Magnetic Observatory for examination and report, and was highly approved by him. The outer shell of the compass is a brass tube, on one end of which an ordinary Ramsden eye-piece is attached. There is a glass diaphragm on which are etched two close parallel vertical lines. The needle is of the regular edge bar type, with one end bent up at right angles and ground to a very fine edge. This end swings sufficiently close to the glass diaphragm to give a good definition of the bent up edge of the needle when the eye-piece is focussed on the lines on the diaphragm. A pointing is made by bisecting the space between the two vertical lines with the needle. Only one end of the needle can, of course, be read. It is found, however, that this is more than compensated for by the increased accuracy of the readings. The needle lifter is operated by means of a milled-headed screw at the end of the compass remote from the eye-piece. The method of fastening this compass to the standard is an improvement on that used with the trough compass, and assures better permanency of the index correction.

The director of the Meteorological Service expects to establish a self-recording declinometer this season, somewhere in the province of Alberta. This will be of great value in the reduction of our observations.

Returns for magnetic declination received to date for 1913.....	1,295
Previous returns, since 1908	4,119
Total returns, to date	5,414
Dip observations received for 1913	145
Previous returns, since 1908	144
Total force observations for 1913	94
Previous returns, since 1908	120

Astronomical Work.

Azimuth Observations.—All the azimuth observations taken on base lines and meridians during the summer season of 1912 and the winter season of 1912-13 have been received at this office and examined during the year. The effect of the careful examinations made and the strict supervision which has been exercised by this office in regard to the accuracy of the meridians and base lines run, is now becoming evident in the great increase in the accuracy of the work being done. The following table shows a brief résumé of the azimuth work of the four seasons 1909-12:—

	1909.	1910.	1911.	1912.
Average correction per mile of line	5.5	6.5	2.7	2.1
Miles of line per azimuth station	4.3	3.8	3.9	4.5
Average number of observations per azimuth station	1.6	2.0	2.4	2.6
Average range of observations at an azimuth station	17"	14"	11"	9"

The greatly reduced average corrections to the lines run in the different seasons illustrate very clearly that much greater skill and care are being exercised to run an accurate line on the theoretic bearing. No less important is the fact that the determinations of azimuths are much more accurate than formerly, as is evidenced both by the smaller range of the observations and by the greater number of observations taken at

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a station. Thus where, a few seasons ago, the azimuth of the line was often determined and a correction applied on the result of one comparatively poor observation with an uncertainty of fifteen or twenty seconds, it is now customary to take two or more observations at a station determining the azimuth usually to within five seconds. The objectionable practice of making corrections to the line on the result of a single observation is now but seldom resorted to.

The instruments used for observing during the seasons 1909-12 were, with but one or two exceptions reiterating instruments, having a six-inch circle with three verniers reading to 0.004 degrees (14".4). The new pattern of transit now being used by all base line surveyors, furnished with a micrometer eye-piece and micrometer microscopes, should result in a still further improvement in the accuracy of the azimuth determinations and of the azimuths of the lines run. From the examination of the 1913 observations already received, this expectation would seem to be fully realized.

The larger parties now being employed, and the faster progress usually attained, often make it difficult for a surveyor to observe at such frequent intervals along the line as formerly; under these conditions it is necessary that a close supervision be kept, to ensure that no surveyor shall allow other considerations to stand in the way of his attaining a requisite degree of accuracy in his surveys.

The more northern latitudes in which the meridians and base lines are now being established, and the greater precision required in the azimuth observations, have necessitated a revision of the azimuth observing books and an extension of the tables of addition logarithms as given in table XVII of the Supplement to the Manual.

Star List.—In observing for latitude by Talcott's method, the latitude of the point of observation governs the stars eligible for making the determination; and since an observation may be required at any point north of the international boundary, it follows that a large number of suitable stars must be available. The various ephemerides and star catalogues published, as a whole, contain this information; but the number, size, and weight of the books prohibit their use in the field, where transportation is always so difficult. Also the fact of having to refer to so many separate books was decidedly inconvenient.

To obviate these difficulties, a Catalogue of Stars has been prepared embodying in one book the information of the different ephemerides and star catalogues, and this information has been reduced to the common epoch 1910.0 and put in the form most convenient for latitude work.

The Star Catalogue comprises over 5,000 suitable latitude stars, and the work involved in compiling the list was considerable, being in excess of 66,000 separate computations. Much data useful in latitude computations are given in the catalogue, and the various methods of star reductions are explained.

In conjunction with the revised and extended 1914 edition of the Star charts, this Star catalogue gives all the information necessary for latitude work in the field.

Astronomical Field Tables.

On account of the large amount of subdivision work now being made in the Peace River district, it has been found necessary to extend the Astronomical Field Tables from township 80 to township 140. In addition to giving the altitude and azimuth of Polaris, the field tables gave the sun's apparent right ascension for each day, and the right ascensions of forty-five bright stars for time observations.

As the apparent path of Polaris, due principally to precession and aberration, is such that the star has almost the same position in January, February, and March of one year, and April, May, and June of the next, taking a mean position of the star for these periods introduces no great error. Similarly a mean position may be taken for November and December, September and October, and July and August of three

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consecutive years. In order that the tables may be issued in time, they must be computed almost a year before required. The Nautical Almanac is supposed to be published two years ahead, but every year the computation of the tables has been delayed by the difficulty experienced in getting it, and each year this difficulty has increased. The right ascension and declination of Polaris can be extrapolated from the positions of former years, giving no appreciable error in the mean position of the star. In the same way the positions of the time stars can also be found sufficiently accurately from former values. But this method was not applicable for finding the right ascension of the sun. It was therefore decided to make a change in the form of the tables, the sun's right ascension being omitted from the Polaris tables and given separately for a whole year. The change was first made for the 1914 tables.

In the past two years a number of surveyors have been employed making traverses of lakes, etc. Often they spend only a short time at one place. On account of cloudy weather, frequently they have been unable to observe the pole star and have been compelled to resort to sun observations. Tables were therefore prepared giving the sun's apparent declination.

The maximum error in the table for the azimuth of Polaris is now much greater than when the tables were first prepared. Extending the tables from township 80 to township 140 has increased it by over 16 per cent. The change in the path of Polaris has produced a still greater effect, and as the error due to this cause is increasing, an investigation will be made with the purpose of finding a more suitable arrangement of months.

Levelling.

The levelling operations of the branch are now under the direction of Mr. J. N. Wallace at Calgary, but as he was not in a position during the past year to plot profiles from the levels, this work has been done here.

Profiles have been made showing levels run along 1,324 miles of base lines and meridians. These profiles are made on a large scale for office use, and on a smaller scale for publication in the annual report.

Surveying Instruments.

The work of this division includes the outfitting of surveyors with surveying instruments, such as transit theodolites, precise levels and levelling rods, stadia rods, steel measuring tapes, clinometers, aneroid barometers, sidereal watches, surveying cameras, etc. These are all of special design, adapted to the conditions and requirements of Dominion lands surveys. A complete stock of instruments is maintained, and they are packed and shipped, as required, to the surveyors in the field. Repairs to surveyors' instruments are also made under the supervision of this office. As upwards of seventy survey parties have to be cared for each season, a considerable amount of work is involved. To give some idea of this, it may be stated that 393 packages, weighing about 16,500 pounds, or 8½ tons, were shipped out by express last year, and 142 packages, weighing about 8,200 pounds, or over 4 tons, were received.

Surveys Laboratory.

During the past year ten block survey transits, fifty-four D.L.S. subdivision transits, and eighteen levels have been tested, adjusted, and the constants determined. Forty-nine sidereal watches have been tested for isochronism and temperature compensation. In addition to the regular work, a large amount of time was devoted to the installation of the new apparatus at the Comparator building. A special cut-out arrangement for the new Cooke astronomical transit has been designed and constructed, and also a low temperature box for watch testing.

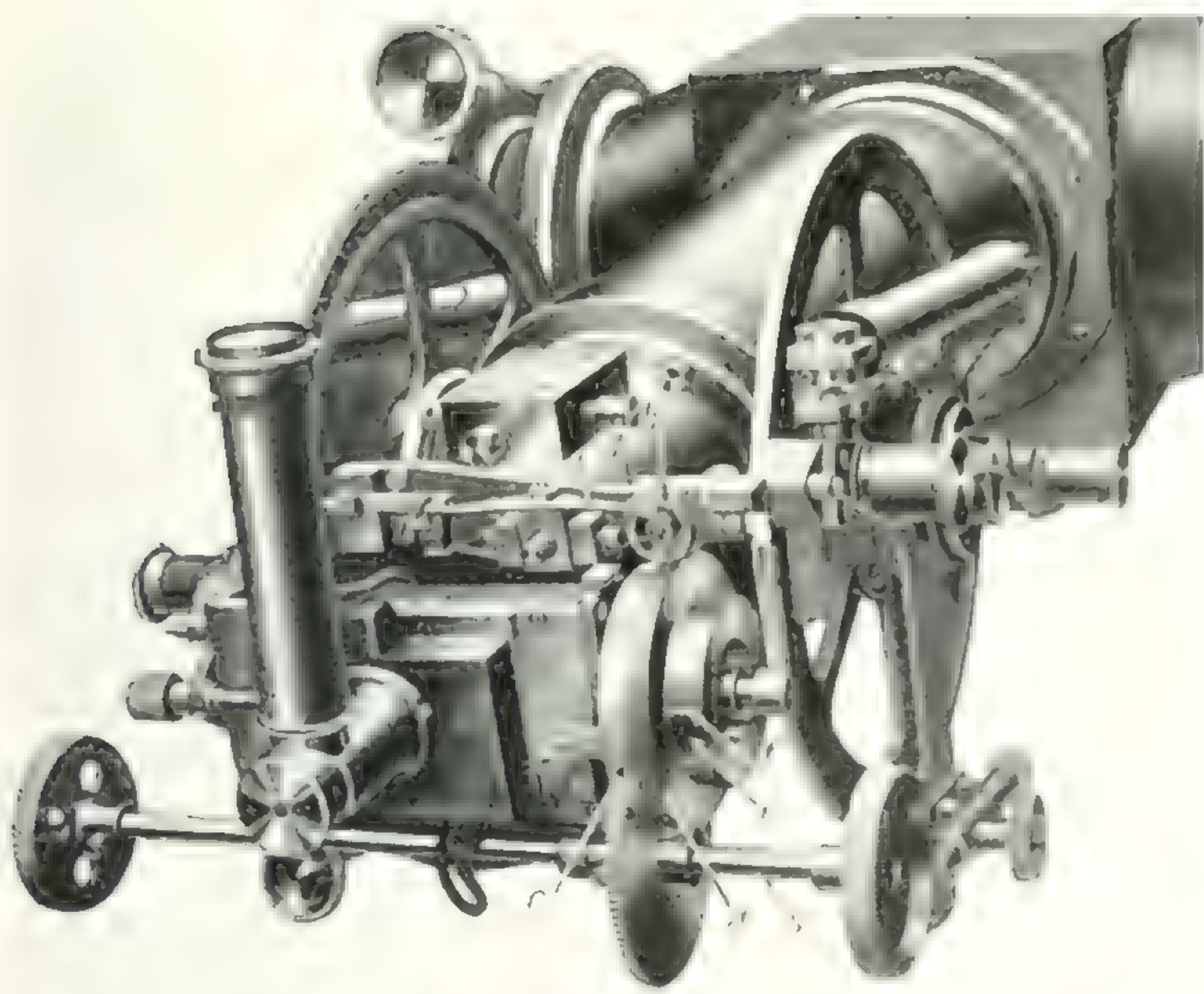


FIG. 2.
Transit Micrometer — Drum on Right.

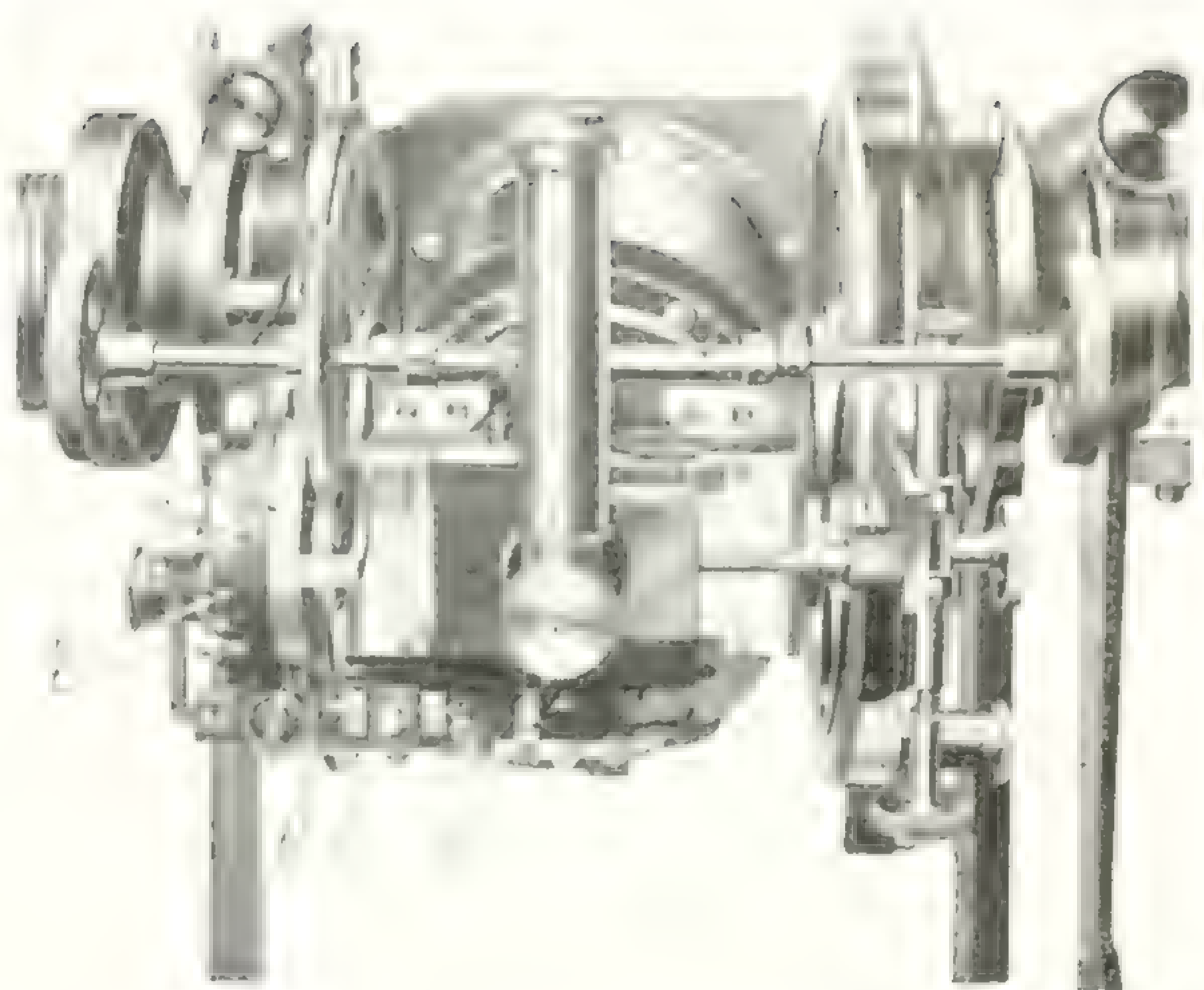


FIG. 3.
Transit Micrometer — Drum on Left.

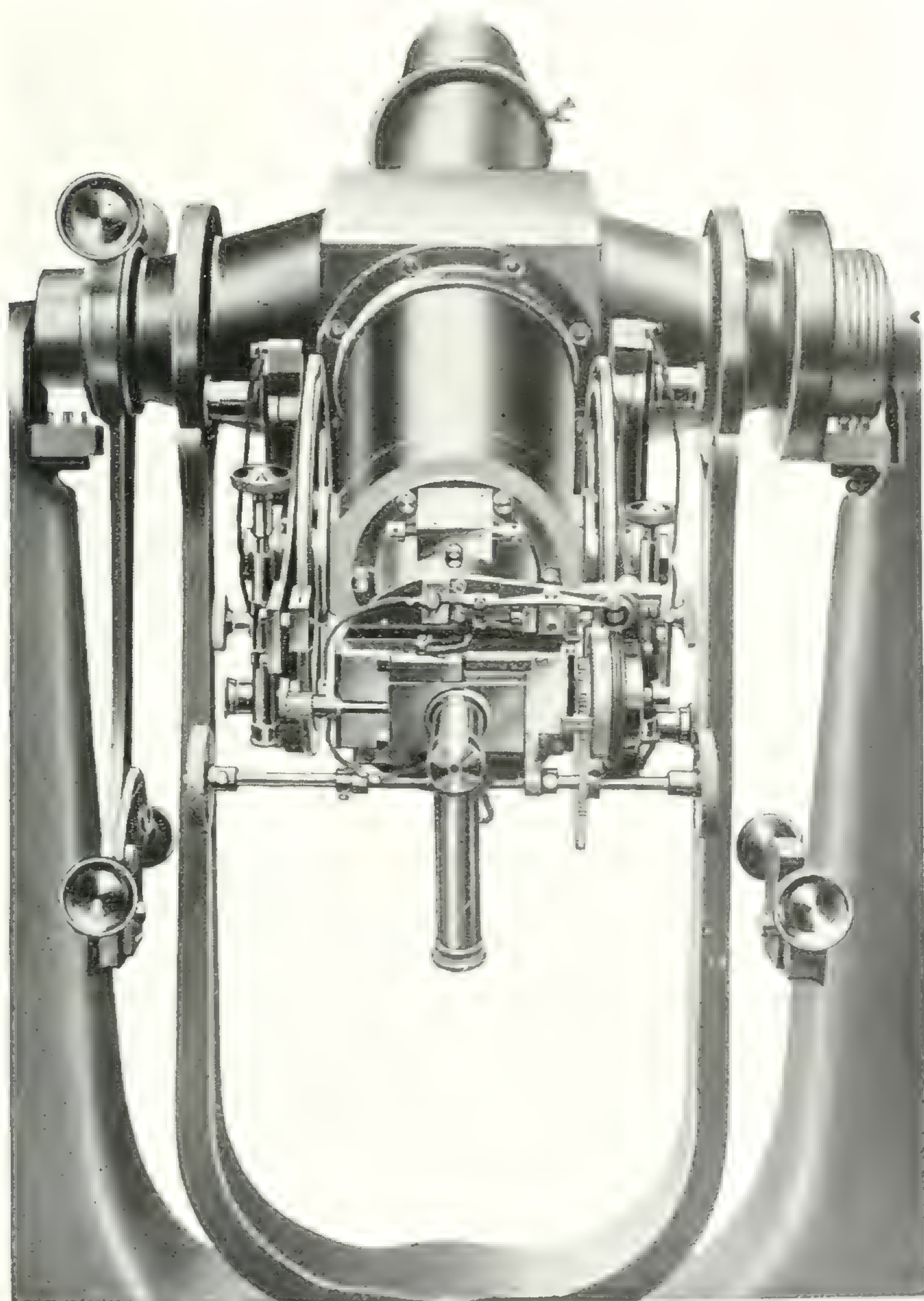


FIG. 4.
Astronomical transit with Transit Micrometer.

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All the watches purchased by the department and afterwards sold to surveyors for use on Dominion lands surveys are submitted to test before being accepted. The test is of forty-four days' duration, divided into eight periods of five days each, with four intermediate and extra days.

1. Watch in the vertical position, pendant up, temperature 65° .
2. Watch in the vertical position, pendant right, temperature 65° .
3. Watch in the vertical position, pendant left, temperature 65° .
4. Watch in the horizontal position, dial up, temperature 40° .
5. Watch in the horizontal position, dial up, temperature 65° .
6. Watch in the horizontal position, dial up, temperature 90° .
7. Watch in the horizontal position, dial down, temperature 65° .
8. Watch in the vertical position, pendant up, temperature 65° .

The four intermediate days when the rate of the watch is not recorded are at the commencements of the fourth, fifth, sixth and seventh periods, which are extended one day each for that purpose.

The watches are set going and allowed to run for a week in the dial-up position before the tests begin.

The conditions of the tests are as follows:—

1. The mean daily variation of the mean daily rate in any period must not exceed 2 seconds.
2. The mean error α of the mean daily rates for all the periods must not exceed 0.75 seconds.
3. The mean daily rate in any one of the five position tests must not differ from the mean of the mean daily rates in the five positions by 7.5 seconds.
4. The mean error β of change of rate for change of position must not exceed 3.5 seconds.
5. The mean daily rate at 40° F. must not differ from the mean daily rate at 90° F. by more than 0.3 seconds per degree F.

All watches which fail to meet these conditions are not accepted. The conditions are pretty severe for ordinary commercial watches; only the most skilled workmen in the factories are able to adjust the watches with the required delicacy. Of the forty-nine tests made during the year, five were special tests, and forty-four regular. Twenty-three watches passed the test, and as two of these were examined twice, 25 or 57 per cent of the tests were successful as against 15 or 25 per cent for the preceding year. The much larger percentage of watches which passed during the last year is undoubtedly due to the fact that the makers now realize that greater care must be given to the adjustments, if the watches are to be accepted.

In reference to the conditions of the test, conditions 1 and 2 are the tests for isochronism, 3 and 4 for position, 5 for temperature compensation. Of the nineteen watches which failed, four were withdrawn before their tests were completed. Of the remaining fifteen, five failed to fulfil condition No. 1, five condition No. 2, seven condition No. 3, and seven condition No. 4, or seven watches failed in isochronism, nine in position, and one in temperature compensation.

Comparing the average errors of the watches which passed with those for 1913 we have the following:—

	1913.	1914.
Average error for isochronism.....	0.559	0.45
Average error for position....	2.58	2.03
Average error for compensation.....	0.14	0.10

The average errors for isochronism of the twenty-three watches which passed were as follows:—

P.U	P.R.	P.L	D.U.	D.U.	D.U.	D.D.	P.U.
			40°	65°	90°		
Os.59	Os.50	Os.42	Os.44	Os.47	Os.38	Os.32	Os.48

The smallest error for α was 0^s.26. Ten were less than 0^s.4 and two less than 0^s.3. It is interesting to note that both in the watches which passed and in those which failed the average error is lowest in the dial-down position and highest in the pendant-up position. In the temperature tests the lowest errors for isochronism were in both cases in the 90° temperature box.

The average errors for position of the watches which passed are as follows:—

P.U	P.R.	P.L.	D.U.	D.D.
1s.84	2s.46	2s.65	1s.59	1s.81

The smallest error for β was 0^s.72. Eleven were less than 2^s.0 and two less than 1^s.5. Both in the watches which passed and in those which failed the largest average error is in the pendant-left position.

The compensation for temperature is remarkable. The average temperature coefficient is 0^s.09. One watch had a coefficient of 0^s.02, and one a coefficient of 0^s.03. Of the forty-nine tested, only one exceeded the limit.

The results of the trials of the twenty-three watches which passed is given in Appendix 50.

Past experience has shown the hot-water temperature box to be preferable to the straight electric type. Being unable to purchase a temperature box from any standard line to run at 40° F., it was decided to have one constructed locally to our own specifications. It was considered advisable to provide a much larger ice chamber than usually supplied, also as perfect insulation as possible. Figure 1 shows a section through the temperature box as finally constructed.

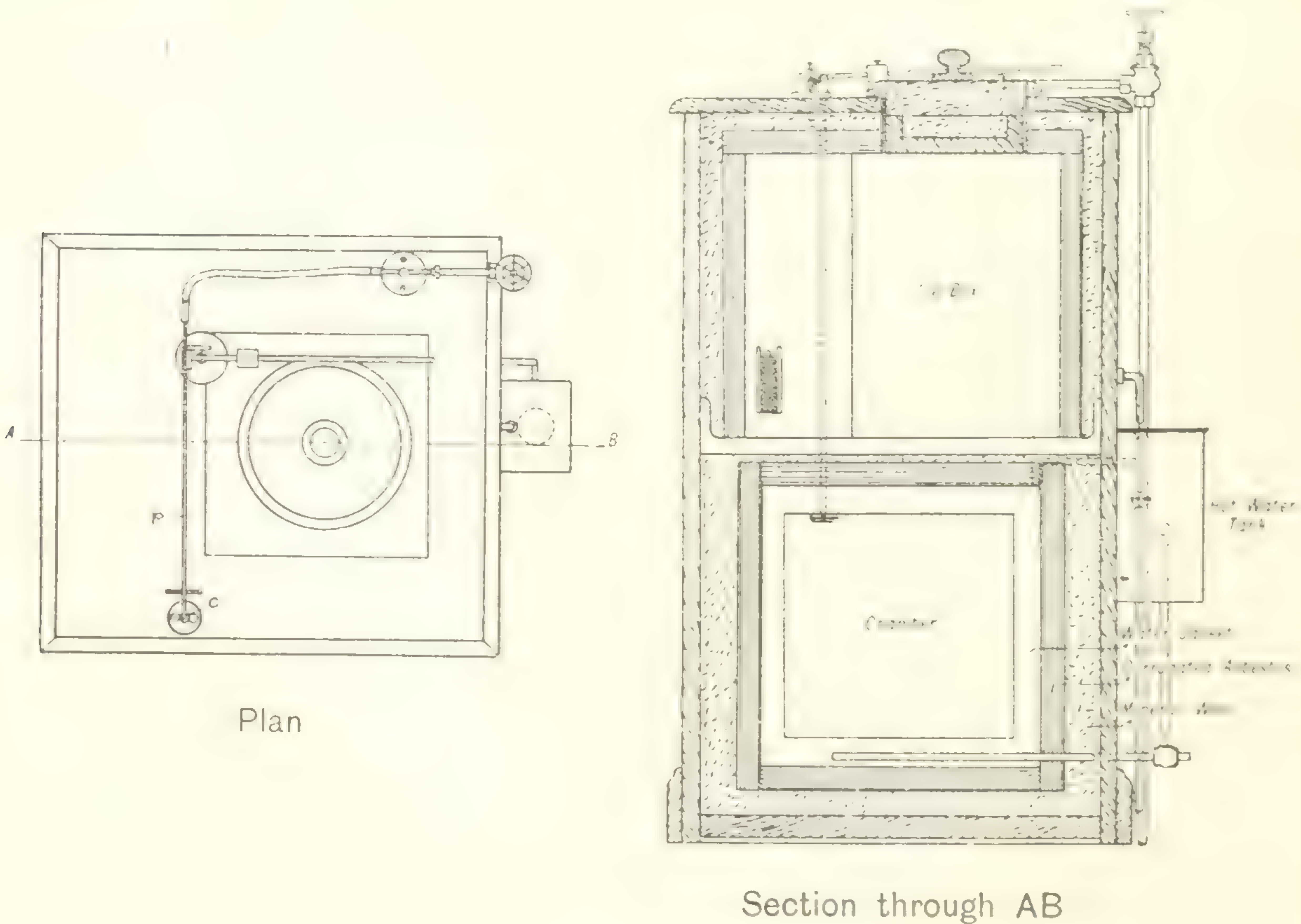


FIG. 1.—Temperature box, 40° Fahrenheit, for watch testing.

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Surrounding the ice-box and temperature chamber is a special insulating material, $1\frac{1}{4}$ -inch thick, of corrugated asbestos sheathing, affording five alternate air spaces and sheathings of asbestos. Between this special insulation and the wall of the temperature box is a space varying from 1-inch to $1\frac{3}{4}$ -inch, filled with mineral wool. The chamber of the temperature box is fitted with two tight-fitting doors, with an air space between them.

The water jacket surrounding the chamber has been increased 50 per cent above that used in ordinary temperature boxes of this type. The increase in water space decreases the liability to any sudden change of temperature in the chamber. One other special feature is the addition of a small separate chamber in the ice-box compartment from which the cold water flows to the jacket surrounding the chamber. Before the water from the ice chamber can enter this compartment it passes through a fine sieve to remove any dirt and prevent clogging of the piping inside.

The regulator parts, proper, are very similar to those used on the Hearson temperature boxes. A capsule inside the chamber expands or contracts with slight changes in temperature, and causes the feed pipe "P" to swing to the right or to the left, as necessary to correct the temperature and the water flows into the hot-water tank or ice chamber and from there to the water jacket. When the temperature is correct in the chamber, the feed pipe remains in a central position and the water flows away through the waste pipe "C".

Some difficulty was experienced in obtaining a liquid sufficiently volatile to be used in the capsules at 40° F. Rhegolene was first used, as it boils below this temperature, but it was found the vapour pressure was not great enough to be used in the ordinary capsule. Ether is now used in place of rhegolene. The capsules can only be filled during the cold weather.

The temperature box has been in operation for some time and has given excellent results, the variation in temperature in the chamber being less than $\frac{1}{2}^{\circ}$ F.

Time observations for checking the rate of our clock have been taken in the past with a small portable transit made by Messrs. Troughton and Simms. The instrument is very old, and at some time has evidently received very rough usage and is in bad repair. This year a new instrument was purchased from Messrs. Cooke and Sons. The telescope has a 3-inch objective of 36 inches focal length, and is fitted with a transit or registering micrometer. The instrument has a beautiful telescope and the workmanship on the whole transit is very fine, but the transit micrometer as furnished was not complete in that no cut-out was provided and no means of identifying the various contacts. After using the instrument for some time in this way, it was finally decided to design a cut-out apparatus ourselves and have the necessary alterations to the micrometer made locally. The principle of the cut-out design is somewhat similar to that used by the United States Coast and Geodetic Survey at Washington. The mechanical construction, however, is entirely different owing to the fact that no arrangement was provided by the makers for such a device on the instrument. It was found difficult to place the mechanism in a neat and compact manner.

While installing the cut-out, the opportunity was taken of improving the recording device, which was of the break-circuit type. The standard voltage of the chronograph is four volts and, with a small voltage of this nature in conjunction with the break circuit, misleading records are liable to occur due to any dirt or irregularity on the contact surfaces, unless an unduly high pressure is maintained between them. The recording device was changed to the make-circuit type, the micrometer transmitting its records through a relay to the chronograph. This permits the use of a strong current through the contact points of the micrometer head, ensuring the record of each contact and a minimum pressure upon the micrometer head by contact spring.

The cut-out provides that the micrometer transmits no records except those made within an accepted space on either side of the line of collimation and forming the observations of transit of the star.

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Figures 2 and 3 show the construction as finally adopted. In Figure 4 is shown the complete instrument, with attachment.

The micrometer screw which carries the slide with the movable wire is geared to the hand wheel shaft (*s*) by a two-to-one gearing. Mounted on the micrometer screw is the micrometer drum (*c*), worm gear (*d*), and ebonite drum (*e*) with contact strips (*f*). On the end of the telescope is mounted a fibre bracket (*g*) which carries the break-contact device, and gear (*h*), the gear engaging with the worm gear (*d*). This turning of gear (*h*)—of which the upper part is slotted—by the worm gear, causes lever (*l*) to break the contact at proper intervals. One special feature of gear (*h*) is that the upper half may be removed and replaced by another part giving different periods of contact. A second feature is the double pitch of the worm gear (*d*) which ensures a rapid make and break contact.

The instrument with this mechanism is now in use and is giving entire satisfaction.

The Comparator building has been completed and the comparator installed. While the equipment is not yet altogether complete, it is possible to make very precise measurements and to verify the tests of our D.L.S. subsidiary standards with confidence. That a building of this nature is needed for the engineering profession in Canada is evident from the number of requests which have been received from surveying instrument dealers and others to have measures verified. Although the comparator has been in operation but a short time, 153 tapes have been tested for outside parties at their request. For Dominion lands survey purposes, 112 D.L.S. subsidiary standards have been standardized, and also eighteen surveying tapes for base line surveyors. Four precise levelling rods have also been tested. A description of the apparatus and method of testing will be published later in separate monograph form.

Correspondence.

The number of draft letters prepared was 1,808. Seventy letters of instructions to surveyors were prepared, and 490 memoranda written.

PHOTOLITHOGRAPHIC OFFICE.

(H. K. Carruthers, Process Photographer.)

About 1887 saw the beginning of the photographic office. All maps and plans were reproduced by the wet-plate process, and from these negatives the photo-litho transfer was made.

A specially prepared India paper was coated and sensitized, and when dry was exposed to the light through the negative. Afterwards this print was inked over with a thin coating of lithographic transfer ink and washed under the tap, when a complete fac-simile of the original was obtained. Immediately this was transferred to the prepared stone previous to its being printed in the power press.

This system had many drawbacks, as after sensitizing the paper it had to remain over night to dry, and should the following day be dark or rainy, exposures could not be made. This was before arc lamps were installed. If this print was incorrectly exposed, it meant a spoiled paper. Another big disadvantage was the copying of a map in sections. After passing through many stages of wettings no two sections were alike in size and had to be faked in the joining.

In 1903 the first and present up-to-date photolithographic plant was installed. Negatives ranging from 18 inches by 20 inches down to 8 inches by 10 inches were made. All plans and townships were drawn on larger sizes and reduced to proper scales, making the final results clear and sharp. Thin sheets of fine-grained zinc were

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used in printing from the negatives, and these could be stored away indefinitely for future use. Larger printing frames were installed with 5,000 c.p. arc lamp, and a large tournette for the coating of the zinc plates. The largest zinc plate used at this time was 18 inches by 20 inches, larger plates being unnecessary, as the camera did not accommodate larger sizes.

To facilitate handling the township plans, which were increasing in numbers, a special iron bed was obtained for the printing press. This bed was the thickness of standard litho stone, and with the clamps attached to each end, the zinc plates, with the image thereon, were securely fastened on, ready for the run. This method obviated the necessity of pulling transfers and materially increased the output in the printing department. The average number of impressions taken from each township was 225.

In 1910 the department installed a large offset printing press, taking plates 49 inches by 32 inches and steps were taken to enlarge the size of our camera to take negatives 28 inches by 32 inches. A large vacuum printing frame, 62 inches by 38 inches and four 50-inch mercury vapour tubes were installed, the dark-rooms and sinks being increased in size.

The townships were photographed on glass 15 inches by 18 inches. Three of these negatives were placed side by side and exposed on the 49 by 32-inch sheet of zinc. Three-mile sectional maps that had previously been copied in two sections were now done on one negative with headings and footnotes complete. These were placed on the press and printed without any further preliminaries.

Ten years ago the average number of negatives made monthly was fifty-four. During the month of March, 1914, a total of 275, ranging in size from 24 inches by 32 inches to 8 inches by 10 inches, was the output.

The staff at present consists of the photographer, four assistants, and two apprentices.

A schedule of the work for the year is given in Appendix No. 7.

PHOTOGRAPHIC OFFICE.

(J. Woodruff, Chief Photographer.)

General photographic work has increased about 50 per cent over that of last year. It has grown to such an extent that more help and larger quarters must be secured or the work will have to be curtailed. Even now it has been found necessary to curtail some of the work which we have been doing for other branches of the department. For the Forestry Branch alone nearly 10,000 prints were made, and about 1,000 negatives developed.

The space in the top floor of the Metcalfe Street building being required by the process photographer, most of the apparatus belonging to the chief photographer was moved to the basement, the blue-print and Vandyke work only being now done on the top floor.

A new camera (Fig. 5), specially designed for enlargements has been installed in the basement. Accuracy and a wide range of usefulness are its two outstanding features.

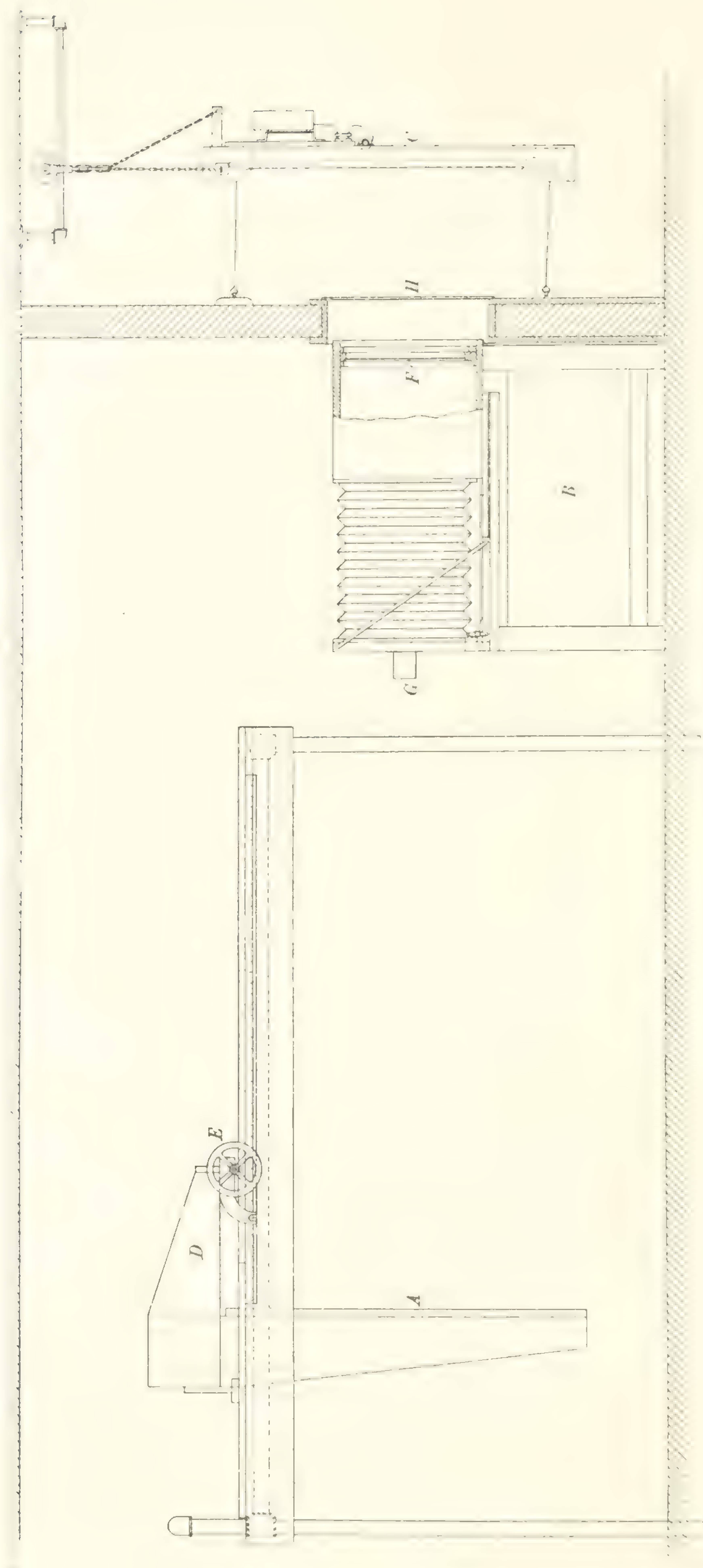


FIG. 5. Vertical Section of Enlarging Camera.

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The whole arrangement consists of three parts, the easel *A*, on which the sensitive paper is placed, the camera *B*, which carries the negative *F* and lens *G*, and the light *C*, which illuminates the negative, *H* being ground glass between the negative and the light. The easel is supported on a frame of steel tubing with four 2½-inch posts, the lower ends of which are embedded in the concrete floor, making the frame perfectly rigid. The dimensions of the frame are 5 feet wide and 11 feet long. A steel track *I* (Fig. 6) runs the length of the frame on each side. A rack *J* runs on

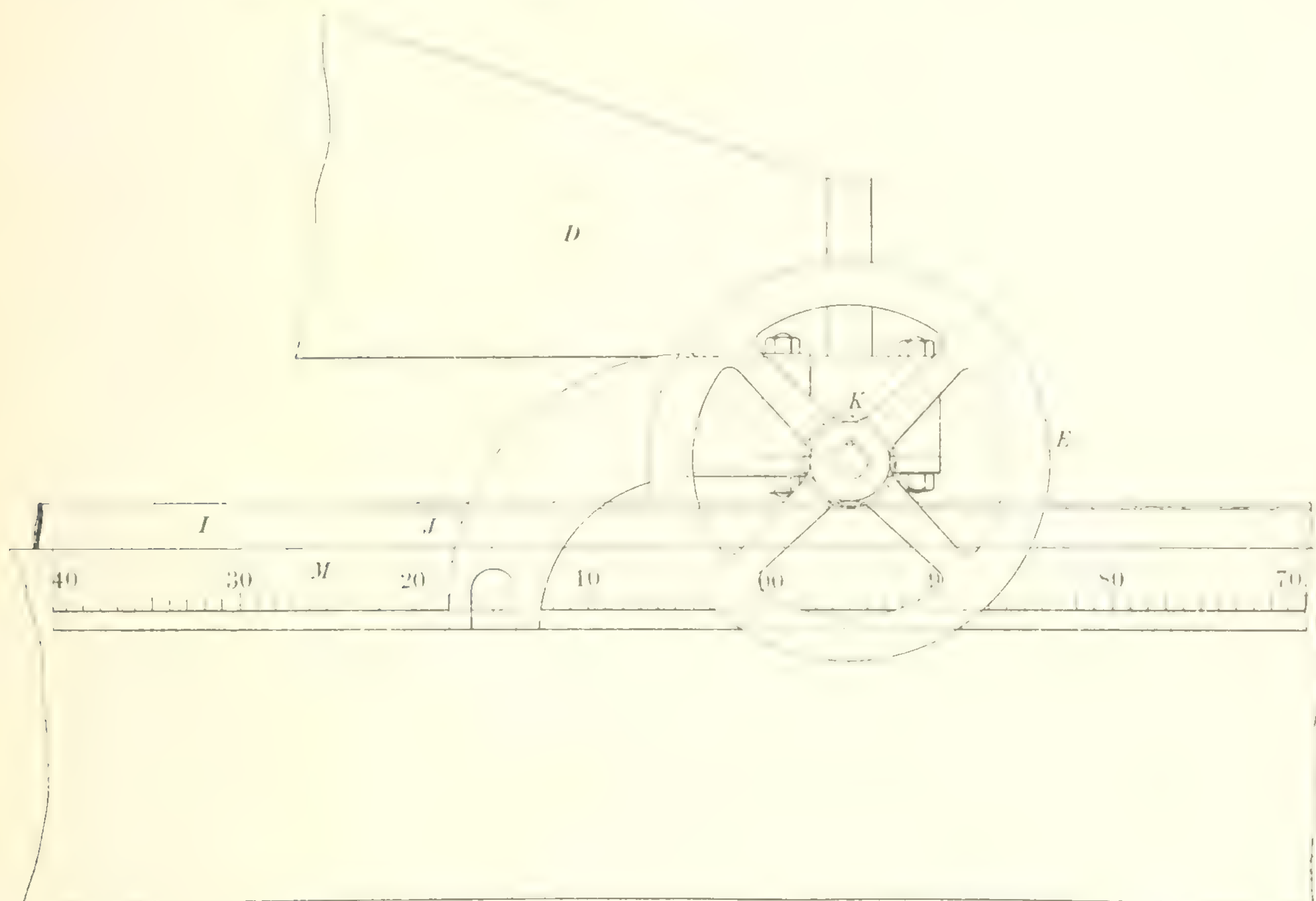


FIG. 6 -- Rack and Scale for easel carriage -- Enlarging Camera.

the frame supporting the carriage *D* which carries the easel, and enabled it to be moved forward or backward by means of a hand wheel *E* and pinions *K* which engage the rack.

The easel is 4 feet by 5 feet, and will take an enlargement of that size.

The camera is 4 feet long and 2 feet square, and will take a negative up to 20 inches square. It is supported on a heavy frame bolted to the floor. Adjustment is provided for by the crank *N* (Fig. 7), operating pinion *O* on rack *P*.

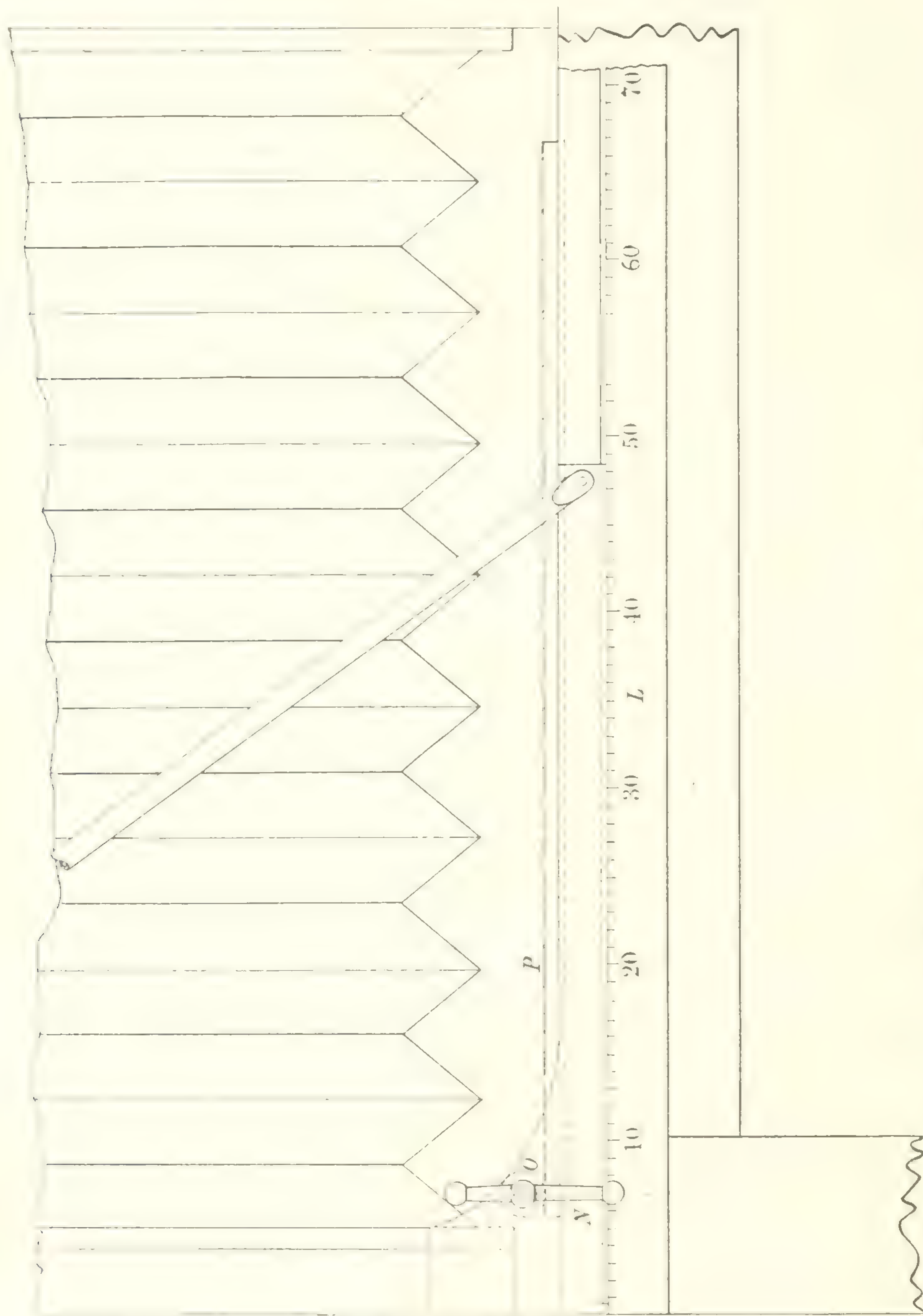


FIG. 7. Rack and Scale for lens—Enlarging Camera.

The camera and easel are fitted with scales *L* and *M*, graduated to millimeters. This does away with all focussing, as the apparatus is simply set to scale for any size of enlargement.

The camera is also used for making lantern slides and transparencies of all sizes.

The light *C* (Fig. 5), consists of five Cooper Hewitt mercury vapour tubes which give a fine even illumination, and is much more satisfactory than daylight. A ground glass *H* is placed in front of the light, behind the negative, to diffuse the light still further.

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A great deal of time is saved by this camera in reducing or enlarging maps, plans, etc., to the required scale; work which formerly required weeks to perform is now done in a few hours, and in a much more satisfactory manner.

The numerical strength of the staff is the same as last year, one clerk resigning and one being appointed.

LITHOGRAPHIC OFFICE.

(*A. Moody, Foreman.*)

The work of the lithographic office continues to increase steadily, as shown by the statement of work done, in Appendix 8. Two power presses are used, one a flat-bed machine capable of printing either from stone or from zinc plates, the other a rotary offset press printing from zinc plates only. One essential difference between the presses is that for the flat-bed press the work on the plate or stone is reversed, so that when the sheet of paper to be printed comes in contact with the work and receives a print, the print reads correctly. With the offset press the work on the plate reads correctly; a reverse print is made to a rubber blanket which in turn prints a correct copy on the paper. It is therefore necessary in preparing work for these presses to keep in mind this difference, as any plate prepared for one press must be reversed before the other press can print it. This reversing may be done by transferring but this usually thickens up the work and causes a loss of sharpness. A preferable way is to reverse by photography, and as most of the work is photographed, it is merely necessary to determine upon which press a job is to be printed, and the photographer arranges the matter by copying either direct or through a mirror as desired. The offset press is a later development in lithography and is capable of a higher rate of speed than the flat-bed. It is therefore used in long runs. The printing of annual report maps and of township plans forms the bulk of the work turned out. Of the latter, 203 copies only are printed; 3 on linen, 170 on thin paper for mailing purposes, and 30 on thick paper for ordinary office use.

More time is required for preparation and adjustment of press to meet the conditions relative to the printing on each kind of paper than would be required for a straight run on only one kind of paper. The same would apply regarding the necessity for frequent changes when more than one colour is used in printing a plan or map.

The flat-bed press is easier to change from one colour to another, and is consequently used much for colour work or for short runs. The printing of the 3-mile sectional maps in three colours, black, blue, and brown, has been undertaken, and provides considerable additional work for the flat-bed press. Reprints of township plans originally issued in colours have also given much colour work.

The largest size of paper used is 24 inches by 34 inches, so that the maximum size of map which can be printed is about 22 inches by 32 inches, varying a little with the allowance for margin.

GEOGRAPHIC BOARD OF CANADA.

(*A. H. Whitcher, Secretary.*)

The twelfth annual report of the board, containing a consolidation of the decisions published in previous reports up to June 30, 1913, has been published and distributed. This report is now printed as a supplement to the report of this department, as the chairman of the board is the Surveyor General. The secretary is also a member of the staff of the Topographical Surveys Branch.

Regular meetings of the board have been held throughout the year, and the bulletins containing the decisions published from time to time in the *Canada Gazette*. A number of these bulletins have also been published separately and distributed by the secretary.

BOARD OF EXAMINERS FOR DOMINION LAND SURVEYORS.

(F. D. Henderson, Secretary.)

Two meetings of the Board of Examiners were held during the year. The first was a special meeting for the examination of candidates, and lasted from April 25 to May 29, 1913, inclusive. Examinations were held at Ottawa, Toronto, Calgary, and Edmonton. The second was the regular annual meeting of the board provided for in section 9 of the D. L. S. Act. It lasted from February 9 to April 1, 1914, inclusive. Examinations were held at Ottawa, Halifax, Montreal, Kingston, Toronto, Winnipeg, Regina, Calgary, Edmonton, and Dawson, Y.T. The total number of candidates examined was 287. The following table shows the number who tried at each centre, and the number who were successful:—

Places.	FULL PRELIMINARY.		LIMITED. PRELIMINARY.		FINAL.		D. T. S.		TOTAL.	
	Tried.	Passed.	Tried.	Passed.	Tried.	Passed.	Tried.	Passed.	Tried.	Passed.
<i>April-May, 1913.</i>										
Ottawa	19	6			21	12			40	18
Toronto	5	2			8	6			13	8
Calgary	8	6	3	2	4	2			15	10
Edmonton	11	4	1	0	4	1			16	5
<i>February, 1914.—</i>										
Ottawa	29	6	4	2	19	9	4	1	56	18
Halifax	2	1			2	2			4	3
Montreal	21	8	1	0					22	8
Kingston	28	6							28	6
Toronto	24	4	2	0	9	3			35	7
Winnipeg	5	2			1	0			6	2
Regina	5	3			1	1			6	4
Calgary	11	3	1	1	10	1			22	5
Edmonton	19	4			3	0			22	4
Dawson	2	0							2	0
Total	189	55	12	5	82	37	4	1	287	98

Following are the names of the successful candidates:—

Full Preliminary and Limited Preliminary Examinations (60).

- Alexander, John Bentley, Calgary, Alta.

Bannister, George William, Ottawa, Ont.

Beach, Floyd Kellogg, Calgary, Alta.

Biddell, Cecil Henry, Regina, Sask.

Bonham, John C., Kingston, Ont.

Bostock, Achilles, Banff, Alta.

Buck, Cameron Alexis, Edmonton, Alta.

Burfield, Francis Robert, Calgary, Alta.

Calder, Leslie Raymond, Nanaimo, B.C.

Carroll, John, Toronto, Ont.

Carter, John Lark, Calgary, Alta.

Cohoon, Carl William, Ottawa, Ont.

Cole, William Stanley, Brockville, Ont.

Crowell, Clement William, Yarmouth, N.S.

DesBrisay, Eric Merrill, Vancouver, B.C.

Donaldson, Garnet Hilliard, Ottawa, Ont.
- Lindsay, Charles Crawford, Quebec, P.Q.

Lyon, John Edward, Ottawa, Ont.

Martin, Frederick John, Winnipeg, Man.

Meitz, Walter H., Pembroke, Ont.

Mills, Arthur McIntosh, Ottawa, Ont.

Mills, Thomas Stanley, Kingston, Ont.

MacKenzie, Hugh Ross, Regina, Sask.

McDonald, William Sutherland, Embro, Ont.

McFarlane, Maynard Deedes, Montreal, P.Q.

McIntosh, John Stuart, Morrisburg, Ont.

Nelson, Edward, Streamstown, Alta.

Parker, Henry Albert, Havelock, Ont.

Patterson, George B., London, Ont.

Paul, John McNeill, Calgary, Alta.

Pelletier, Henri Burrough, Montreal, P.Q.

Perry, Alfred Melville, Banff, Alta.

Prittie, Lloyd Conn, Pembroke, Ont.

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Fawcett, Thomas Gordon, Ottawa, Ont.
 Frame, William Taylor, Vancouver, B.C.
 Fullerton, James Thornton, Victoria, B.C.

Gammon, Albert Osborne, Calgary, Alta.
 Gass, Lawrence Henderson, Iroquois, Ont.
 Gray, Edwin Roy, Toronto, Ont.
 Guignard, Ernest Auguste, Ottawa, Ont.

Jones, Cyril, Calgary, Alta.
 Joslyn, Cecil Earl, Sinaluta, Sask.

Keeping, Kimball F., Murray Harbour, P.E.I.
 Kezar, George Lennox, Britannia Heights, Ont.
 Knight, Albert Matthew, Edmonton, Alta.

Lawrence, Charles Albert Rutter, Toronto, Ont.

Prinsep, Garnet T. T., Ottawa, Ont.

Ramsay, James Harold, Ottawa, Ont.
 Riddell, John Morrison, Toronto, Ont.
 Richer, Cuno Edward, Ottawa, Ont.
 Robertson, James, Lachine P.Q.
 Russell, John, Edmonton, Alta.

Scandrett, Frederick Raymond, Calgary, Alta.
 Sharpe, David Neville, Winnipeg, Man.
 Smith, Gordon J., Kingston, Ont.
 Tory, Charles Howard, Edmonton, Alta.
 Trelle, Hermann William, Edmonton, Alta.

Wall, George, Albert, Crescent, Alta.
 Wilkins, Arthur G., Ottawa, Ont.
 Wright, Harold Colin, Sandhurst, Ont.

Final Examination (37).

Alport, Frederic, Orillia, Ont.
 Bartley, Thomas Holmes, Toronto, Ont.
 Barton, Harold Miall, Ottawa, Ont.
 Bingham, Harold Carr, Moosejaw, Sask.
 Bolton, Lambert Ernest Stanley, Wiarton, Ont.

Clarke, Roger Fyfe, Hamilton, Ont.
 Coté, Joseph Martial, Ottawa, Ont.

Dozois, Leo Oswald Ross, Calgary, Alta.
 Dynes, Richard Fforde, Pembroke, Ont.

Edwards, William Muir, Edmonton, Alta.
 Ewan, Hedley Jenkins, Yarmouth, N.S.

Grant, Alexander Macdonald, Ottawa, Ont.
 Griffin, Albert Dyke, Elk Lake, Ont.

Fredette, Joseph Fredelin, Ottawa, Ont.

Huffman, Karl, Toronto, Ont.

Johnston, Robert Henry, Toronto, Ont.

King, James Albert Shirley, Ottawa, Ont.

LeBlanc, Pierre Maxime Henri, Ottawa, Ont.

Logan, Robert Archibald, Middle Mosquodoboit, N.S.

Macdonald, Colin Stone, Ottawa, Ont.
 Macdonald, James Atwood, Ridgetown, Ont.
 Morency, Georges, Lévis, P.Q.
 Moulton, Hazen Parker, Ottawa, Ont.
 MacIlquham, Walter Lloyd, Ottawa, Ont.
 MacRostie, Norman Barrie, Metcalfe, Ont.
 McGarry, Patrick Joseph, Merritton, Ont.
 McKnight, James Henry, Simcoe, Ont.

Norrish, Wilbert Henry, Guelph, Ont.

Pierce, Benjamin Clifford, Kingston, Ont.
 Pounder, Irvine Rudsdale, Ottawa, Ont.

Roberts, Otto Beer, Murray Harbour, P.E.I.

Sharpe, George Pearce, Agassiz, B.C.
 Steers, Francis Paul, Ottawa, Ont.
 Squire, Richard Lane, Ottawa, Ont.

Van Skiver, Leighton Adelbert, Fish Lake, Ont.

Wrong, Frederick Hay, Chatham, Ont.

Young, Stewart, Owen Sound, Ont.

Examination for Certificate as Dominion Topographical Surveyor.

Rannie, J. L., Ottawa, Ont.

The examinations at all the centres are held simultaneously and according to a time-table approved by the board; and the presiding examiners have instructions to transmit each night to the secretary at Ottawa, the answer papers received during the day. As the papers are received at Ottawa they are distributed to the members of the board. The members being busy during the day with departmental business, the papers have to be read at night, and where the number of candidates is large, as it has been for some years, the work becomes very arduous.

At the meeting in April and May, complete sets of papers were prepared for use at the examination in February, 1914, and at the meeting in February other sets were prepared for the examination in April and May, 1914.

For some time it has been felt by the members of the board that the writing of candidates who came before them is very bad and that the answer papers also left much to be desired in the way of neatness and orderly arrangement. After considerable discussion it was decided to amend the rules and regulations so as to provide for a subject "Penmanship and Neatness," for which a certain number of marks would

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be allowed on each paper. "Penmanship" is taken to be "the quality of ordinary writing;" and "neatness," "the clean, orderly, and tidy condition of the written answers to the questions." It is hoped by this means to secure not only more creditable papers from candidates, but to impress upon these young men seeking to enter the surveying profession the need of legible writing and of neatness and care in the preparation of the returns of survey.

Several college graduates applied to be admitted to the shorter term of service as provided in section 22 of the D.L.S. Act. Favourable decisions were given in the case of a graduate in civil engineering of the University of Colorado and in the case of a graduate of the Nova Scotia Technical College at Halifax.

Mulford's "Boundaries and Landmarks" and Cautley's "Descriptions of Land, a Textbook for Surveying Students" were added to the list of books of reference for final candidates.

Thirty-nine commissions as Dominion Land Surveyors were issued to those who had passed the final examination and had furnished the oath of office and oath of allegiance and bond as required by section 25 of the Act.

Thirty-two standard measures were issued during the year. Twenty-eight of these went to Dominion Land surveyors and two to provincial surveyors.

A list of Dominion Land surveyors who are in possession of standard measures, corrected to March 31, 1914, will be found in Appendix No. 10.

The correspondence of the board was as follows: letters received, 1,727; letters sent, 920; circular letters, pamphlets, notices, etc., sent, 1,654.

The following table shows the number who have tried the various examinations each year since 1900, and the number and percentage of successful candidates.

Fiscal Year.	PRELIMINARY.			FINAL.			D. T. S.			TOTAL.		
	Tried.	Passed.	Per cent Passed.	Tried.	Passed.	Per cent Passed.	Tried.	Passed.	Per cent Passed.	Tried.	Passed.	Per cent Passed.
1899-00.....	7	6	86	5	4	80				12	10	83
1900-01.....	5	5	100	5	5	100				10	10	100
1901-02.....	30	26	87	10	9	90				40	35	88
1902-03.....	31	22	71	8	8	100				39	30	77
1903-04.....	43	37	86	18	13	72				61	50	82
1904-05.....	57	42	74	23	20	87	1	0		81	62	77
1905-06.....	36	25	70	27	19	70	4	0		67	44	66
1906-07.....	20	15	75	10	15	75	1	0		41	30	73
1907-08.....	132	67	51	28	21	75	1	0		161	88	55
1908-09.....	224	88	39	52	27	52	3	1	33	279	116	42
1909-10.....	289	97	34	72	37	51	1	0		362	134	37
1910-11.....	186	64	34	69	38	55	2	1	50	257	103	40
1911-12.....	195	57	29	71	48	68	2	0		268	105	39
1912-13.....	187	56	30	83	44	53	1	0		271	100	37
1913-14.....	201	60	30	82	37	45	4	1	25	287	98	34

APPENDICES.

The following schedules and statements are appended:—

No. 1. Schedule of surveyors employed and work executed by them from April 1, 1913, to March 31, 1914.

No. 2. Schedule showing for each surveyor employed from April 1, 1913, to March 31, 1914, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey; also the cost of the same.

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No. 3. List of lots in the Yukon Territory, surveys of which have been received from April 1, 1913 to March 31, 1914.

No. 4. List of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1913, to March 31, 1914.

No. 5. Statement of work executed in the Topographical Surveys Branch.

No. 6. List of new editions of sectional maps issued from April 1, 1913, to March 31, 1914.

No. 7. Statement of work executed in the photographic office from April 1, 1913, to March 31, 1914.

No. 8. Statement of work executed in the lithographic office from April 1, 1913, to March 31, 1914.

No. 9. List of Employees of the Topographical Surveys Branch at Ottawa, on April 1, 1914, with the name, classification, duties of office and salary of each.

No. 10. List of Dominion Land Surveyors who are in possession of standard measures.

Nos. 11 to 57. Reports of surveyors employed.

No. 58. Results of observations for magnetic declination.

No. 59. Results of watch trials.

MAPS AND PROFILES.

The following maps and profiles accompany this report:—

Map showing surveys to March 31, 1914.

Maps to accompany reports of surveyors.

Profiles of meridians and base lines.

I have the honour to be, sir,

Your obedient servant,

E. DEVILLE,

Surveyor General.

TOPOGRAPHICAL SURVEYS BRANCH

SCHEDULES AND STATEMENTS

APPENDIX No. 1.

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to
March 31, 1914.

Surveyor.	Address.	Description of Work.
Akins, J. R.	Ottawa, Ont.	Survey of the east outlines of townships 89 to 92, range 22, the twenty-fourth and twenty-fifth base lines across ranges 18 to 21, the twenty-sixth base line across ranges 18 to 20, and the twenty-seventh base line across ranges 10 to 18 and part of range 9, all west of the fifth meridian.
Allison, C. B.	South Woodslee, Ont.	Contract No. 25 of 1913. Subdivision of townships 33, ranges 11 and 12, and the south two-thirds of townships 34, ranges 11, 12 and 13, west of the principal meridian.
Aylsworth, C. F.	Madoc, Ont.	Resurvey in township 16, range 6, east of the principal meridian; townships 20 and 21, range 3, townships 21 and 22, range 4, and township 23, range 5, west of the principal meridian.
Baker, J. C.	Kingston, Ont.	Contract No. 20 of 1913. Subdivision of townships 57, 58, 59 and 60, range 15, and the north two-thirds of township 60, range 14, west of the third meridian.
Bélanger, P. R. A.	Ottawa, Ont.	Inspection of contracts Nos. 19, 22, 23, 28, 31 and 32 of 1912 and No. 20 of 1913. Subdivision in townships 54 and 55, range 12, west of the third meridian.
Bennett, G. A.	Tillsonburg, Ont.	Correction surveys in townships 10 and 11, range 13, townships 10, ranges 14 and 16, east of the principal meridian; townships 17 and 18, range 20, and townships 20, ranges 21 and 22, west of the principal meridian; township 19a, range 1, township 11, range 6, township 19, range 8, township 7, range 10, townships 19 and 20, range 12, townships 3 and 4, range 18, and township 16, range 30, west of the second meridian; townships 15 and 16, range 2, township 13, range 5, and township 18, range 18, west of the third meridian; township 2, range 19, west of the fourth meridian. Subdivision surveys in townships 18 and 19, range 1, townships 23, ranges 15 and 16, west of the third meridian; township 17, range 5, township 9, range 16, townships 1, ranges 28 and 29, west of the fourth meridian; township 19, range 4, west of the fifth meridian. Retracement

APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
		surveys in township 10, range 8, township 20, range 12, west of the second meridian; township 23, range 9, west of the third meridian; townships 18 and 19, ranges 9, 10 and 11, and townships 1 and 2, ranges 12 and 25, west of the fourth meridian. Resurvey in township 21, range 11, west of the principal meridian; township 24, range 5, townships 25, ranges 5 and 6, and township 22, range 9, west of the third meridian. Traverse in township 10, range 15, east of the principal meridian; township 25, range 9, west of the principal meridian; township 10, range 8, west of the second meridian; townships 25, ranges 5, 6 and 9, township 23, range 15, west of the third meridian; township 17, range 5, and township 2, range 25, west of the fourth meridian; township 24, range 1, west of the fifth meridian. Investigation in township 25, range 9, west of the third meridian.
Blanchet, G. H..	..Ottawa, Ont....	..Survey of the twenty-second base line from the fourth to the fifth meridian.
Boivin, E..	..Chicoutimi, Que....	..Resurvey in township 42, range 28, west of the fourth meridian. Retracement survey in township 53, range 27, west of the fourth meridian. Correction survey in township 49, range 14, west of the fifth meridian.
Boulton, W. J.	..Mattawa, Ont..	..Subdivision in township 3, range 30, west of the fourth meridian; townships 4 and 12, range 1, townships 8, 11, 14 and 15, range 2, townships 8, 10, 13, 14, 15 and 16, range 3, townships 8 and 16, range 4, and township 8, range 5, west of the fifth meridian
Bowman, E. P..	..West Montrose, Ont.	..Investigation and traverse of lakes in township 34, range 11, townships 31, 32 and 34, range 12, townships 29, 30, 31, 33, 34, 35 and 36, range 13, townships 31, 33, 34, 35, 36 and 37, range 14, townships 30, 31, 32, 33, 34, 35, 36, and 37, range 15, townships 31, 32 and 33, range 16, townships 27, 28, 30, 32, 33, 34, 35, 36, 37, 38 and 39, range 18, townships 28, 29, 30, 32, 33, 35, 36, 37, 39, 40 and 41, range 19, townships 29, 30, 31, 34, 35, 36, 37, 38, 39, 40 and 41, range 20, townships 30, 31, 33, 35, 39 and 47, range 21, and townships 47 and 48, range 22, west of the third meridian.
Brenot, L..	..Ottawa, Ont....	..Survey of the east outlines of townships 81, 82, 83 and 84, range 17, townships 81, 82 and 83, range 18, and townships 81, 82 and part of 83, range 19, west of the sixth meridian. Subdivision in townships 83 and 84, range 20, township 84, range 21, township 83, range 22, and township 82, range 25, west of the sixth meridian. Survey of timber berth No. 2052 in townships 80 and 81, ranges 15 and 16, west of the sixth meridian. Mounding in township 79, range 14, west of the sixth meridian.
Bridgland, M. P.	..Calgary, Alta..	..Photo-topographical survey of the northern part of the Crowsnest Forest Reserve.

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APPENDIX No. 1—*Continued.*SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Brown, C. D.	Winnipeg, Man.	Contract No. 19 of 1913. Subdivision of townships 79, 80 and westerly half of township 78, range 22, townships 78, 79 and 80, range 23, west of the fifth meridian.
Buchanan, J. A.	Edmonton, Alta.	Contract No. 1 of 1913. Subdivision of townships 85 and 86, ranges 5 and 6, townships 86 and 87, ranges 7 and 8, west of the sixth meridian.
Calder, J. A.	Lytton, B.C.	Subdivision in townships 15, 16 and 17, ranges 24 and 25, township 15, range 26, townships 15, 16, 17 and 18, range 27, and townships 17 and 18, range 28, west of the sixth meridian. Resurvey in townships 15 and 16, range 25, and township 18, range 27, west of the sixth meridian. Traverse in townships 15, 16 and 17, ranges 24 and 25, township 15, range 26, townships 16, 17 and 18 range 27, and township 18, range 28, west of the sixth meridian.
Chase, A. V.	Orillia, Ont.	Subdivision in townships 12, 13 and 14, range 26, townships 12, 13, 14 and 15, range 27, and township 12, range 28, west of the sixth meridian. Resurvey in townships 12 and 13, range 26, and townships 13 and 14, range 27, west of the sixth meridian. Traverse in townships 12 and 13, range 26, townships 12, 13 and 14, range 27, and township 12, range 28, west of the sixth meridian.
Christie, Wm.	Prince Albert, Sask.	Contract No. 22 of 1913. Subdivision of townships 57, ranges 1, 2, 3, 4 and 5, west of the third meridian.
Coltham, G. W.	Aurora, Ont.	Investigation and traverse of lakes in townships 50 and 52, range 9, townships 49, 50, 51 and 52, range 10, townships 47, 49, 50, 51 and 52, range 11, townships 47, 48, 49, 50, 51 and 52, range 12, townships 47, 48, 51 and 52, range 13, west of the fourth meridian.
Cowper, G. C.	Welland, Ont.	Investigation and traverse of lakes in townships 14 and 15, range 19, townships 12, 14 and 15, range 20, townships 12, 13, 14, 15 and 16, range 21, townships 12, 13, 14, 15, 16 and 17, range 22, townships 12, 13, 14, 16 and 17, range 23, townships 12, 13, 14, 15 and 16, range 24, townships 13, 14, 15, 16 and 17, range 25, townships 12, 13, 14 and 16, range 26, township 14, range 27, all west of the third meridian; townships 12, 13, 15, 16 and 17, range 1, townships 1, 8, 13, 14, 16 and 17, range 2, townships 1, 8, 9, 13, 14, 15 and 19, range 3, townships 1, 9, 18, 19 and 20, range 4, townships 8, 14, 15, 17, 18 and 19, range 5, townships 9, 10, 15 and 18, range 6, townships 3, 4, 5, 18, 20 and 21, range 7, townships 3, 4, 5, 9, 15, 18, 20, 21 and 22, range 8, townships 3, 5, 16, 20 and 21, range 9, townships 18, 19 and 21, range 10, townships 9, 10, 15, 16 and 18, range 11, townships 9, 10 and 19, range 12, townships 5, 9, and 10, range 13, townships 5 and 9, range 14, west of the fourth meridian.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Cumming, A. L.. . . .	Cornwall, Ont.. . . .	Survey of the boundaries of the townsite of Nordegg in township 40, range 15, west of the fifth meridian. Resurveys in township 45, range 23, west of the third meridian, and townships 26 and 27, range 15, townships 50 and 51, range 27, west of the fourth meridian. Correction surveys in township 48, range 22, west of the third meridian; township 65, range 5, townships 58 and 59, range 6, township 55, range 8, and township 50, range 12, west of the fourth meridian. Investigation and traverse of lakes in township 48, range 22, townships 44, 45 and 46, range 23, west of the third meridian; township 55; range 8, township 69, range 10, township 68, range 16, township 38, range 28, west of the fourth meridian; township 38, range 1, townships 51, 52, 53 and 55, range 2, and township 52, range 3, west of the fifth meridian. Survey of timber berth No. 2066 in township 64, range 27, west of the fourth meridian.
Davies, T. A.. . . .	Edmonton, Alta. . . .	Contract No. 15 of 1913. Subdivision of townships 70, 71 and 72, ranges 18 and 19, west of the fourth meridian.
Day, H. S.. . . .	Edmonton, Alta. . . .	Contract No. 16 of 1913. Subdivision of townships 73, 74, 75 and 76, range 18, west of the fourth meridian.
Deans, W. J.. . . .	Brandon, Man.. . . .	Inspection of contract No. 7 of 1911 and No. 23 of 1913. Survey of the 212 foot contour line at Point du Bois falls on Winnipeg river in township 15, range 14, and townships 14 and 16, range 15, east of the principal meridian. Subdivision in townships 45 and 46, range 9, townships 47 and 48, range 10, and townships 14 and 15, range 27, west of the second meridian. Correction survey in township 14, range 29, west of the second meridian. Traverse in township 16, range 14, east of the principal meridian, and township 1, range 20, west of the principal meridian.
Evans, S. L.. . . .	Corinth, Ont.. . . .	Subdivision in township 17, range 3, townships 16, 17, 18, 19 and 20, range 4, township 23, range 5, and township 19, range 7, west of the fifth meridian. Survey of summer resort lots in township 19, range 19, and township 30, range 30, west of the principal meridian. Traverse in township 19, range 19, townships 26 and 27, range 30, west of the principal meridian; township 17, range 4, west of the fifth meridian.
Fawcett, A.	Gravenhurst, Ont. . . .	Contract No. 17 of 1913. Subdivision of township 77, range 18, and townships 75, 76 and 77, range 19, west of the fourth meridian. Survey of east outline of township 74, range 20, west of the fourth meridian.
Fawcett, S. D.. . . .	Ottawa, Ont.. . . .	Settlement surveys at Fort Resolution on Slave river and at Fort Simpson, Fort Wrigley, Fort Norman and Fort Good Hope on McKenzie river.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Fletcher, J. A.	Ottawa, Ont.	Survey of the east outlines of townships 89 to 108, range 18, the twenty-seventh base line across ranges 19 to 21 and the east half of range 22 and the twenty-eighth base line across range 18, west of the fifth meridian.
Fontaine, L. E.	Lévis, Que.	Inspection of contracts Nos. 1, 2 and 3 of 1913. Subdivision in township 84, range 21, and township 83, range 22, west of the fifth meridian; township 71, range 5, townships 71, 72, 78 and 79, range 6, townships 79 and 80, range 7, west of the sixth meridian. Traverse in township 85, range 21, west of the fifth meridian.
Francis, John.	Portage la Prairie, Man.	Contract No. 28 of 1913. Subdivision of part of township 17 and southerly two-thirds of township 18, range 12, southerly two-thirds of township 18, range 13, township 17 and southerly two-thirds of township 18, range 14, and west half of township 17, range 15, east of the principal meridian.
Galletly, J. S.	Oshawa, Ont.	Subdivision in townships 109 and 110, ranges 3 and 4, township 108, range 6, townships 108 and 109, range 11, township 108, range 12, and township 109, range 13, west of the fifth meridian. Survey of the east outline of township 109, range 17, part of the east outline of township 107, range 16, the north outlines of townships 107, ranges 11, 12, 13 and 14, west of the fifth meridian. Traverse in townships 109 and 110, range 3, townships 108, 109 and 110, range 4, township 108, range 6, townships 108, ranges 11 and 12, township 109, range 13, townships 108 and 109, range 14, and township 109, range 15, west of the fifth meridian.
Gibbon, Jas.	Vancouver, B.C.	Contract No. 18 of 1913. Subdivision of townships 60, ranges 10, 11 and 13, and townships 58 and 59, range 14, west of the fifth meridian. Survey of the east boundary of township 60, range 15, west of the fifth meridian.
Green, T. D.	Ottawa, Ont.	Contract No. 14 of 1913. Subdivision of townships 70 and 71, range 23, and townships 69 and 70, range 24, west of the fourth meridian.
Herriot, G. H.	Ottawa, Ont.	Survey of the eighteenth base line across ranges 1 to 16 and the nineteenth base line across ranges 1 to 6 and part of 7, west of the principal meridian.
Hunter, A. E.	Warton, Ont.	Subdivision in township 8, range 25, and townships 8, 9 and 10, range 26, west of the sixth meridian. Resurvey in townships 7, 8, 9 and 10, range 26, west of the sixth meridian. Traverse in township 8, range 25, and townships 8, 9 and 10, range 26, west of the sixth meridian.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to
March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Jackson, J. E.. . .	Hamilton, Ont.. . .	Contracts No. 23 and 24 of 1913. Subdivision of townships 38, 39, 40 and 41, range 24, and part of township 41, range 25, west of the principal meridian. Partial subdivision of townships 40, 41 and 42, range 18, townships 38, 39, 40 and 41, range 19, townships 39, 40 and the northerly third of township 38, range 20, west of the principal meridian.
Johnston, C. E.. . .	Toronto, Ont. . . .	Investigation and traverse of lakes in townships 15, 16, 17, 18, 19, 20, 21 and 22, range 2, townships 15, 16, 17, 18, 19, 20, 21 and 22, range 3, townships 15, 16, 17, 18 and 19, ranges 4 and 5 townships 15, 16, 17, 18, 19 and 20, range 6, townships 15, 16, 17, 18, 19, 24, 25 and 26, range 7, townships 24, 25, 26, 27 and 28, ranges 8 and 9, townships 25, 26, 27 and 28, ranges 10 and 11, all west of the third meridian.
Johnston, J. H.. . .	Edmonton, Alta. . . .	Contract No. 7 of 1913. Subdivision of parts of townships 72, ranges 4 and 5, townships 72 and 73, range 6, part of township 73, range 7, township 74 and part of townships 72 and 73, range 8, townships 72, 73, 74 and parts of townships 71 and 72, range 9, and township 72 and part of township 71, range 10, west of the fifth meridian.
Johnston, W. J.. . .	St. Catharines, Ont. . .	Subdivision in townships 5, 6, 7 and 8, range 26, townships 4 and 5, range 27, townships 3, 4 and 5, range 28, west of the sixth meridian; townships 4 and 5, range 5, west of the seventh meridian. Resurvey in townships 5, 6, 7 and 8, range 26, townships 4 and 5, range 27, and township 4, range 28, west of the sixth meridian. Traverse in townships 5, 6 and 7, range 26, township 4, range 27, and townships 3 and 4, range 28, west of the sixth meridian; township 4, range 5, west of the seventh meridian.
Lighthall, A.. . . .	Vancouver, B.C.. . . .	Contract No. 26 of 1913. Subdivision of townships 24 and 25, ranges 8 and 9, and the southerly two-thirds of township 26, range 9, east of the principal meridian.
Lonergan, G. J.. . .	Buckingham, Que. . . .	Inspection of contracts Nos. 14, 15 and 37 of 1912, and 5, 6, 7, 8, 9, 10 and 18 of 1913. Traverse in township 75, range 14, west of the fifth meridian. Survey of Lesser Slave Lake and Wabiskaw settlements.
MacLeod, G. W.. . .	Edmonton, Alta. . . .	Contract No. 3 of 1913. Subdivision of township 72 and northerly two-thirds of township 71, range 1, east half of northerly two-thirds of township 71 and east half of township 72, range 2, township 73, northerly two-thirds of township 70 and southerly third of township 71, range 4, northerly two-thirds of township 70 and southerly third of township 71, ranges 5 and 6, township 69, range 9, township 69 and southerly two-thirds of township 70, range 10, west of the sixth meridian.

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APPENDIX No. 1—*Continued.*SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Martindale, E. S.	..Kingsmill, Ont...	Survey of the fifteenth base line across ranges 22 to 27 and the sixteenth base line across ranges 14 to 27, west of the second meridian.
Matheson, H.	..Ottawa, Ont....	Surveys along the Canadian Northern railway in townships 47 and 48, ranges 17 and 18, west of the fifth meridian. Survey of Fitzhugh townsite, villa lots at Pyramid and Patricia lakes and corrals at Jasper in township 45, range 1, west of the sixth meridian. Correction survey in Lake St. Anne settlement in township 54, range 3, west of the fifth meridian. Topographical survey in Jasper Forest Park in townships 44 and 45, range 1, and township 45, range 2, west of the sixth meridian. Traverse of road from Jasper to Pyramid and Patricia lakes, and traverse of Pyramid and Patricia lakes in township 45, range 1, west of the sixth meridian.
McFarlane, J. B.	..Toronto, Ont.	Survey of the twenty-fourth base line across ranges 7 to 11 and part of range 6, and the twenty-fifth base line across ranges 1 to 12, west of the fourth meridian.
McGrandle, H.	..Wetaskiwin, Alta.	Contract No. 11 of 1913. Subdivision of townships 69 and 70, ranges 25, 26 and 27, west of the fourth meridian.
McKay, R. B.	..Vancouver, B.C.	Subdivision in townships 1, ranges 28 and 29, west of the sixth meridian; townships 17, 19, 21, 22 and 25 east of the coast meridian; township 39 west of the coast meridian. Resurvey in townships 1, ranges 28 and 29, west of the sixth meridian; townships 14, 17, 19, 21, 22, 23, 25 and 40 east of the coast meridian; and township 39 west of the coast meridian. Traverse in townships 1, ranges 28 and 29, and township 3, range 30, west of the sixth meridian; townships 22, 23 and 24 east of the coast meridian; and township 39 west of the coast meridian.
Miles, C. F.	..Toronto, Ont.	Inspection of contracts Nos. 13 and 33 of 1912, and 11, 12, 13, 14, 15, 16 and 17 of 1913. Traverse in township 73, range 19, west of the fourth meridian. Subdivision in townships 45, ranges 9 and 10, west of the second meridian; township 70, range 18, and township 73, range 19, west of the fourth meridian.
Narraway, A. M.	..Ottawa, Ont....	Retracement surveys in townships 6 and 7, range 30, west of the third meridian; townships 5 and 6, ranges 3, 4 and 5, township 6, range 6, townships 1 and 2, ranges 9 and 10, and township 21, range 10, west of the fourth meridian. Resurveys in townships 18 and 19, range 9, townships 18, 19, 20 and 21, range 10, township 21, range 11, townships 21 and 22, range 12, and townships 2 and 3, ranges 14 and 15, west of the fourth meridian. Subdivision surveys in townships 18 and 19, range 10, township 21, range 11, and townships 21 and 22, range 12, west of the fourth meridian. Traverse in townships 8, ranges 22 and 23, township 10, range 24, townships 9 and 10, range 25, and township 9, range 26, west of the fourth meridian.

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APPENDIX No. 1—*Continued.*SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Neelands, R.. . . .	Hamiota, Man.	Investigation and traverse of lakes in townships 39 and 40, range 17, townships 39, 40 and 41, range 18, townships 38, 39, 41, 42, 44, 45 and 45a, range 22, townships 38, 39, 40, 41, 42 and 44, range 23, townships 38, 39, 40, 41, 42, 43 and 44, range 24, townships 38, 39, 40, 41, 42 and 43, range 25, townships 39, 40, 41 and 49, range 26, townships 46 and 49, range 27, township 46, range 28, west of the second meridian; township 46, range 1, west of the third meridian.
Neville, E. A.. . . .	Vancouver, B.C.. . . .	Contract No. 6 of 1913. Subdivision of townships 72, 73 and part of township 71, range 11, townships 72, 73 and 74, range 12, townships 73, ranges 13, 14 and 15, west of the fifth meridian.
Palmer, P. E.. . . .	Dorchester, N.B.. . . .	Subdivision in township 52, range 29, townships 50 and 51, range 30, township 50, range 31, and townships 49 and 50, range 32, west of the principal meridian; townships 48, 49 and 50, range 1, townships 47 and 48, range 2, and townships 46 and 47, range 3, west of the second meridian. Survey of the east outlines of township 49, range 30, and townships 49, 51 and 52, range 31, west of the principal meridian; townships 46, 49 and part of township 45, range 2, township 48, range 3, and townships 47 and 48, range 4, west of the second meridian. Retracement of the east outlines of townships 45 and 46, range 3, west of the second meridian. Survey of the north outlines of township 49, range 31, west of the principal meridian, and of township 47, range 1, west of the second meridian.
Pearson, H. E.. . . .	Edmonton, Alta.	Contract No. 12 of 1913. Subdivision of townships 71 and 72 and part of township 73, range 26, west of the fourth meridian; township 72 and parts of townships 70, 71 and 73, range 1, and part of township 70, range 2, west of the fifth meridian. Survey of part of east outline of township 70, range 27, west of the fourth meridian.
Pierce, J. W..	Ottawa, Ont..	Contract No. 21 of 1913. Subdivision of townships 57 and 58, range 13, townships 57 and 58 and the southerly two-thirds of township 59, range 14, west of the third meridian. Survey of the east outlines of townships 59 and 60, range 13, and of township 60, range 14, west of the third meridian.
Pinder, Geo. Z.. . . .	Edmonton, Alta.	Contract No. 10 of 1913. Subdivision of townships 67, 68 and 69, range 1, the northerly two-thirds of township 67 and parts of townships 68 and 69, range 2, west of the fifth meridian.
Plunkett, T. H.. . . .	Ottawa, Ont..	Survey of the thirteenth base line from the northeast corner of township 48, range 28, west of the principal meridian easterly to the western shore of lake Winnipeg, and the fourteenth base line from the northeast corner of township 52, range 28, easterly to the western shore of lake Winnipeg.

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APPENDIX No. 1—*Continued.*SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Ponton, A. W.. . .	Edmonton, Alta. . .	Contract No. 5 of 1913. Subdivision of townships 76, ranges 7, 8, 9 and 10 and parts of townships 75, ranges 7, 8 and 9, west of the fifth meridian.
Purser, R. C.. . . .	Windsor, Ont. . . .	Subdivision in township 33, range 6, township 39, range 19, and township 34, range 25, west of the third meridian. Resurveys in township 29, range 15, west of the principal meridian; township 27, range 24, west of the second meridian; township 42, range 6, and township 26, range 12, west of the third meridian. Correction surveys in township 47, range 14, township 42, range 16, and township 33, range 28, west of the second meridian, and township 51, range 27, west of the third meridian. Retracement in township 33, range 31, west of the principal meridian; township 26, range 11, township 42, range 16, and township 25, range 27, west of the second meridian; township 30, range 3, township 47, range 4, townships 47, 48 and 55, range 5, township 29, range 17, townships 40, ranges 23 and 24, and township 51, range 27, west of the third meridian, and township 34, range 21, west of the fourth meridian. Traverse in township 29, range 15, and township 33, range 31, west of the principal meridian; townships 25, ranges 4 and 5, township 33, range 10, townships 26 and 33, range 11, and township 33, range 12, west of the second meridian; township 37, range 1, township 33, range 6, township 53, range 7, township 50, range 23, and township 34, range 25, west of the third meridian. Investigation in township 29, range 17, west of the second meridian; township 45, range 23, and township 51, range 27, west of the third meridian; and township 33, range 10, west of the fourth meridian.
Rinfret, C.. . . .	Montreal, Que. . . .	Investigation and traverse of lakes in townships 4, 5 and 7, range 19, townships 2, 3, 4, 5, 7 and 8, range 20, townships 2, 3, 4, 5, 6, 7, 8 and 9, range 21, townships 2, 3, 4, 5, 6, 7 and 8, range 22, townships 2, 3, 4, 5, 6 and 7, range 23, townships 4, 5, 6 and 7, range 24, townships 3, 4, 5, 6 and 7, ranges 25 and 26, townships 3, 4, 5 and 6, range 27, townships 4, 5 and 6, range 28, townships 3, 4, 6 and 9, range 29, and townships 3, 4, 5 and 6, range 30, west of the second meridian. Retracement surveys in township 2, range 21, and township 6, range 25, west of the second meridian.
Robinson, E. W.. . .	Ottawa, Ont.	Production of the second meridian from the northeast corner of township 78 to the quarter section post on the east boundary of section 13, township 85.
Rolfson, O.	Walkerville, Ont.	Survey of the sixteenth base line across ranges 26 to 31, and the seventeenth base line across ranges 6 to 20, west of the principal meridian.

APPENDIX No. 1—Continued.

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—Continued.

Surveyor.	Address.	Description of Work.
Roy, G. P. J.	Quebec, Que.	Subdivision surveys of the parts of township 41, range 13, township 37, range 3, township 37, range 4, and township 39, range 9, west of the second meridian; and townships 36, ranges 30 and 31, west of the principal meridian not included in the Porcupine Forest Reserve. Survey of timber berth No. 2055, blocks 1 and 2 in townships 42 and 43, range 11, west of the second meridian. Retracement of part of the north outline of township 35, range 31, west of the principal meridian, north outlines of townships 36, ranges 3 and 4, and part of the east outline of township 37, range 5, west of the second meridian. Traverse in township 37, range 4, west of the second meridian.
Saint Cyr, A.	Ottawa, Ont.	Survey of the third meridian from the eighteenth to the nineteenth base line, and the nineteenth base line across ranges 1 to 17, west of the third meridian.
Saint Cyr, J. B.	Montreal, Que.	Investigation and traverse of lakes in townships 32 and 33, range 14, township 32, range 15, townships 34 and 35, range 16, townships 34, 35, 36, 37 and 38, range 17, townships 34, 35, 36, 37 and 38, range 18, townships 35, 36, 37, 38 and 39, range 19, townships 31, 34, 37 and 38, range 20, townships 29, 38 and 39, range 21, townships 35, 36, 37, 38, 39 and 40, range 22, townships 34, 35, 36, 37, 38, 39 and 40, range 23, townships 35, 36 and 37, range 24, townships 35, 37 and 41, range 25, townships 36, 37, 40 and 41, range 26, townships 34, 36, 39 and 40, range 27, townships 36, 37, 39, 40, 41 and 42, range 28, west of the fourth meridian; townships 40, 41, 42 and 43, range 1, west of the fifth meridian.
Segré, B. H.	Toronto, Ont.	Investigation and traverse of lakes in township 25, range 18, townships 23, 24, 25 and 26, range 19, townships 20 and 25, range 20 townships 20, 21, 25 and 26, range 21, townships 17, 18, 20, 21, 24, 25 and 26, range 22, townships 17, 18, 20, 21, 22, 23, 24, 25, 26 and 28, range 23, townships 18, 22, 23, 24, 25, 26, 27 and 28, range 24, townships 17, 18, 19, 25, 26, 27 and 28, range 25, townships 19, 20, 21 and 22, range 26, townships 22, 23, 25 and 26, range 27, and township 18, range 30, west of the second meridian; township 18, range 1, west of the third meridian.
Seibert, F. V.	Edmonton, Alta.	Survey of the twenty-first base line from the fourth to the fifth meridian. Retracement of the east outline of section 36, township 80, range 1, west of the fourth meridian.
Steele, I. J.	Ottawa, Ont.	Contract No. 4 of 1913. Subdivision of townships 76, ranges 11, 12 and 13 and parts of townships 75, ranges 10, 11, 12 and 13, west of the fifth meridian.

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APPENDIX No. 1—*Continued.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
Stewart, N. C.	Ottawa, Ont.	Subdivision of townships 23 and 24, range 17, and township 23, range 18, west of the fifth meridian; townships 23, ranges 2, 3, 4, 5 and 6, township 18, range 8, township 20, range 9, townships 18 and 21, ranges 10 and 11, townships 21 and 25, range 12, townships 24 and 25, range 13, and township 25, range 14, west of the sixth meridian. Resurvey in township 23, range 18, west of the fifth meridian; township 23, range 1, townships 22 and 23, range 2, townships 23, ranges 4 and 5, townships 19 and 20, range 9, townships 18 and 21, range 10, township 21, range 11, townships 21 and 25, range 12, and townships 25, ranges 13 and 14, west of the sixth meridian. Traverse in townships 22 and 23, range 2, townships 23, ranges 3, 4 and 5, township 21, range 11, township 25, range 12, township 24, range 13, and township 25, range 14, west of the sixth meridian.
Stock, J. J.	Ottawa, Ont.	Contract No. 8 of 1913. Subdivision of township 66 and parts of townships 67 and 68, range 3, townships 65, 66 and part of township 67, range 4, and township 65 and southerly half of township 66, range 5, west of the fifth meridian. Survey of timber berth No. 1935 in township 62, range 4, and townships 60 and 61, range 5, and timber berth No. 1918 in township 59, range 12, west of the fifth meridian.
Street, P. B.	Toronto, Ont.	Subdivision in township 61, range 20, township 60 and 61, range 21, townships 59 and 60, range 22, townships 58 and 59, range 23, townships 57 and 58, range 24, township 54, range 26, and townships 53 and 54, range 27, west of the principal meridian. Traverse in township 61, range 20, township 60, range 21, townships 59 and 60, range 22, townships 59, range 23, township 58, range 24, township 54, range 26, township 53, range 27, and township 54, range 27, west of the principal meridian.
Stuart, A. G.	Buckingham, Que.	Retracement of the second base line from the principal to the second meridian, the east boundary of range 31 from the international boundary to the northeast corner of township 24, and the fifth, sixth and seventh base lines across ranges 31 to 33, west of the principal meridian; the third base line across ranges 1 to 7 and the east boundary of range 7 from the northeast corner of township 8 to the northeast corner of township 16, east of the principal meridian.
Taggart, C. H.	Kamloops, B.C.	Subdivision in townships 16 and 17, range 13, townships 18 and 19, ranges 14 and 15, township 21, range 18, township 20 and 21, range 19, townships 21, ranges 20 and 21, township 22, range 22, townships 21 and 22, range 23, townships 18, 19 and 21, range 24, townships 18, 19, 20, 21 and 22, range 25, townships 19, 20 and 21, range 26, and township 20, range

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APPENDIX No. 1—*Continued.*SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Continued.*

Surveyor.	Address.	Description of Work.
		27, west of the sixth meridian. Resurvey in townships 18 and 19, range 15, townships 21, ranges 18, 19, 20 and 21, township 22, range 22, townships 17, 18, 19, 20 and 21, range 24, townships 18, 19 and 21, range 25, and townships 20, ranges 26 and 27, west of the sixth meridian. Traverse in township 19, range 15, townships 21, ranges 18 and 21, townships 22, ranges 22 and 23, townships 17, 18, 19, 20 and 21, range 24, townships 18, 19, 20 and 21, range 25, and township 21, range 26, west of the sixth meridian.
Taylor, W. E.	Toronto, Ont.	Contract No. 27 of 1913. Subdivision of townships 21, 22 and 23, range 9, and parts of townships 21, 22 and 23, range 8, east of the principal meridian.
Tipper, Geo. A.	Brantford, Ont.	Contract No. 2 of 1913. Subdivision of townships 85, 86 and 87, range 23, townships 86 and 87, ranges 24, 25 and 26, west of the fifth meridian. Survey of the east outlines of townships 88, ranges 23 and 24, and of townships 85 and 88, ranges 25 and 26, west of the fifth meridian.
Tremblay, A. J.	Edmonton, Alta.	Contract No. 13 of 1913. Subdivision of township 72, range 23, and townships 71 and 72 ranges 24 and 25, west of the fourth meridian. Survey of the east outlines of townships 70, ranges 24 and 26, west of the fourth meridian.
Waddell, W. H.	Edmonton, Alta.	Contract No. 9 of 1913. Subdivision of township 72 and part of townships 73 and 74, range 2, townships 73 and part of townships 74, ranges 3, 4 and 5, township 74 and part of townships 75 and 76, range 6, all west of the fifth meridian.
Walker, C. M.	Guelph, Ont.	Surveys of cemeteries at Banff and Bankhead Alberta and Field, B.C. Traverse, levels and supervision of the construction of roads in the neighbourhood of Banff. Survey of small parcels of land for leaseholds in township 25, range 12, township 28, range 18, and township 26, range 26, west of the fifth meridian. Survey of golf links and recreation grounds at Banff. Contour survey and a survey for the location of improvements in the villa lot section of Banff.
Wallace, J. N.	Calgary, Alta.	Levelling along Athabaska river from Athabaska to Lesser Slave lake; along Athabaska river down stream from Athabaska to the twentieth base line west of the fourth meridian; along the Canadian Pacific railway from Edmonton to Calgary; along the Canadian Northern railway from Edmonton to Lloydminster; along the Hudson Bay railway northeast from Hudson Bay Junction to the fifteenth base line west of the principal meridian; along the Canadian Northern railway east and south from Hudson Bay Junction to Swan River.

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APPENDIX No. 1—*Concluded.*

SCHEDULE of Surveyors employed and work executed by them from April 1, 1913, to March 31, 1914—*Concluded.*

Surveyor.	Address.	Description of Work.
Waugh, B. W.	Ottawa, Ont.	Production of the principal meridian from the northeast corner of section 24, township 72, to the northeast corner of township 80; the twenty-first base line across ranges 1 to 9 east of the principal meridian, and the twentieth base line across ranges 1 to 3, west of the principal meridian, and ranges 1 to 7, east of the principal meridian.

APPENDIX No. 2.

SCHEDULE showing for each surveyor employed from April 1, 1913, to March 31, 1914, the number of miles surveyed of township section lines, township outlines, traverses of lakes and rivers and resurvey, also the cost of the same.

Surveyor.	Miles of section.	Miles of outline.	Miles of traverse.	Miles of resurvey.	Total mileage.	Total cost.	Cost per mile.	Day work or contract.
						\$	\$ cts.	
Akins, J. R.		147			147	23,377	159 03	Day.
Allison, C. B.	180	30	7		217	6,146	28 32	Contract.
Aylsworth, C. F.				195	195	10,533	54 02	Day.
Baker, J. C.	260	52	25		277	8,717	31 47	Contract.
Bennett, G. A.	16	4	54	158	232	5,267	22 70	Day.
Blanchet, G. H.		152		7	159	25,589	157 27	"
Boulton, W. J.	152	12	9	44	197	12,890	65 43	"
Bowman, E. P.			214		214	7,027	32 84	"
Brenot, L.	100	74	43		217	26,767	123 32	"
Brown, C. D.	227	58			285	9,060	31 68	Contract.
Buchanan, J. A.	339	185			524	17,601	33 59	"
Calder, J. A.	121		52	3	176	8,314	47 24	Day.
Chase, A. V.	42		56	8	106	8,316	78 74	"
Christie, Wm.	202	54	95		349	9,167	26 27	Contract.
Coltham, G. W.			373		373	7,281	19 52	Day.
Cowper, G. C.			425		425	5,489	12 92	"
Cumming, A. L.	1		77	122	200	8,754	43 77	"
Davies, T. A.	241	86	88		415	13,094	31 55	Contract.
Day, H. S.	168	60	74		302	8,887	29 43	"
Evans, S. L.	129	6	20	8	158	9,559	60 50	Day.
Fawcett, A.	168	72	28		268	8,182	30 53	Contract.
Fletcher, J. A.		152			152	24,542	161 46	Day.
Francis, J.	166	42	36		244	7,236	29 66	Contract.
Galletly, J. S.	181	87	119		387	15,755	40 71	Day.
Gibbon, Jas.	208	36	56		300	9,047	30 16	Contract.
Green, T. D.	168	36			204	6,789	33 28	"
Herriot, G. H.		133			133	19,549	146 98	Day.
Hunter, A. E.	44		57	3	104	8,240	79 23	"
Jackson, J. E.	385	127	215		727	18,018	24 78	Contract.
Johnston, C. E.			259		259	5,872	22 67	Day.
Johnston, J. H.	263	55	63		381	11,159	29 29	Contract.
Johnston, W. J.	52		55	2	109	9,779	89 72	Day.
Lighthall, A.	138	30	62		230	6,591	28 66	Contract.

APPENDIX No. 2—Concluded.

SCHEDULE showing for each surveyor employed from April 1, 1913, to March 31, 1914, the number of miles surveyed, &c.—Concluded.

Surveyors.	Miles of sections.	Miles of outline.	Miles of traverse.	Miles of resurvey.	Total mileage	Total cost.	Cost per mile.	Day work or contract.
MacLeod, G. W.	427	52	123	16	618	17,574	33 93	Contract.
Martindale, E. S.		196			196	26,820	136 84	Day.
McFarlane, J. B.		105		1	106	23,132	218 23	"
McGrandle, Hugh	196	52	48		296	8,325	28 13	Contract.
McKay, R. B.	42		23	24	89	10,091	113 38	Day.
Narraway, A. M.	40		64	450	554	9,632	17 39	
Nedlands, R.			572		572	7,313	12 78	"
Neville, E. A.	261	12	33		306	9,366	30 61	Contract.
Palmer, P. E.	211	156	8	12	387	12,680	32 76	Day.
Pearson, H. E.	218	47	99		364	10,710	29 42	Contract.
Pierce, J. W.	190	72	74		336	9,127	27 16	"
Pinder, G. Z.	244	28	39		311	9,139	29 39	"
Plunkett, T. H.		211			211	20,592	97 59	Day.
Ponton, A. W.	206	54	14		274	8,783	32 05	Contract.
Purser, R. C.	2		46	43	92	7,053	76 66	Day.
Rinfret, C.			506		506	6,017	11 89	
Rolfson, O.		117			117	25,093	214 47	"
Roy, G. P. J.	121		9	25	155	12,495	80 61	"
Saint Cyr, A.		126			126	26,394	209 48	"
Saint Cyr, J. B.			603		603	6,862	11 38	"
Segré, B. H.			407		407	6,745	16 57	"
Seibert, F. V.		153		1	154	26,022	168 97	"
Steele, I. J.	221	39	36		296	7,732	26 12	Contract.
Stewart, N. C.	84		32	9	125	10,220	81 76	Day.
Stock, J. J.	272	51	12		335	11,866	35 42	Contract.
Street, P. B.	196	70	61		327	13,094	39 95	Day.
Stuart, A. G.				490	490	8,704	17 75	"
Taggart, C. H.	189		35	13	237	10,772	45 45	"
Taylor, W. E.	139	28	53	3	223	6,041	27 09	Contract.
Tipper, G. A.	305	174	139		618	16,800	27 18	"
Tremblay, A. J.	206	80	69		355	11,113	31 30	"
Waddell, W. H.	276	83	83		442	12,437	28 14	"
Waugh, B. W.		164			164	29,636	180 70	Day.
Total	7,918	3,760	5,748	1,632	19,058	821,004		

APPENDIX No. 3.

List of lots in the Yukon Territory, survey returns of which have been received from April 1, 1913, to March 31, 1914.

GROUP 2.

Lot No.	Acres.	Surveyor.	Year of Survey.	Date of Approval.	Claimant.	Remarks.
348	100·00	F. H. Kitto	1913	Sept. 25, 1913	Patrick Roach	Surface.
351	160·00	"	1913	Mar. 20, 1914	Joseph Rousseau	"
357	40·00	"	1913	" 20, 1914	"	"
363	51·65	"	1912	July 28, 1913	Amanda Savory	Virgin mineral claim
364	30·23	"	1912	" 28, 1913	"	Virgin No. 2, M.C.
366	10·89	"	1913	Jan. 22, 1914	Lone Star Limited	Surface.

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APPENDIX No. 3—Concluded.

GROUP 3.

21	160'00	F. H. Kitto.....	1914	Feb. 23, 1914	V. E. Ferry.....	Surface.
24	51'67	"	1913	Mar. 26, 1914	Donald McKinnon, <i>et al.</i> ...	Lion, M. C.
25	51'31	"	1913	" 26, 1914	"	Thistle, M.C.
26	51'31	"	1913	" 26, 1914	"	Hidden Treasures, M.C.
29	40'27	"	1913	" 26, 1914	"	Talisman, M.C.
30	160'00	"	1913	Feb. 17, 1914	Donald McKinnon	Surface.
31	51'63	"	1913	Mar. 26, 1914	Donald McKinnon, <i>et al.</i> ...	Argyle, M.C.
32	51'65	"	1913	" 26, 1914	"	Drumkinnon, M.C.
33	51'52	"	1913	" 26, 1914	"	Roseneath, M.C.

GROUP 4.

9	160'00	F. H. Kitto.	1913	Dec. 19, 1913...	Geo. Grenier.....	Surface.
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GROUP 10.

34	141'70	F. H. Kitto.	1913	Mar. 26, 1914..	M. H. Boulais & Jos. Viau.	War Eagle, M.C.
35	98'00	"	1913	" 26, 1914...	" Paul Guite	Bunker Hill, M.C.
36	36'00	"	1913	" 26, 1914...	L. A. Herdt.	Susie, M.C.
37	41'11	"	1913	" 26, 1914...	Victor and Joseph Dupont.	Glenlivet, M.C.

APPENDIX No. 4.

List of miscellaneous surveys in the Yukon Territory, returns of which have been received from April 1, 1913, to March 31, 1914.

Year.	Surveyor.	Description of Survey.
1912	F. H. Kitto.	Base line on part of Tenmile creek, a tributary of Sixtymile river.
1913	"	Base line on part of Barlow and Clear creeks.
1912	"	" " Minto creek.
1912	"	Reference traverse from mouth of Clear creek, on Stewart river to mouth of Fla creek on Klondike river.
1913	"	Reference traverse on McKinnon creek, a tributary of Indian river.
1911	"	Triangulation topographical survey on Klondike watershed.
1913	H. G. Dickson..	Ibex river reference traverse Whitehorse district.
1912	"	Base line on Nansen creek a tributary of Nisling river.
1912	"	" Summit " Nansen creek.
1912	"	" Courtland " "
1912	"	" Dolly " "
1912	"	" Webber " "
1912	"	" Cabin " "
1912	"	" Center " "
1912	"	" Newbauer " "
1912	"	" Discovery pup " "
1912	"	" Shaw creek " "
1912	"	" Eliza " "
1912	"	" Rush " "
1912	"	" Slate " "
1912	"	" East Fork " "
1912	"	" South " "
1912	"	" Victoria creek a tributary of Nisling river.
1912	"	" Dome " "
1912	"	" Back " "

APPENDIX No. 5.

STATEMENT of work executed in the Topographical Surveys Branch.

Letters of instruction to surveyors.....	365
Progress sketches received and filed.....	1,304
Declarations of settlers received and filed.....	107
Returns of timber berths received.....	11
Plans received from surveyors	762
Field books received from surveyors.....	782
Timber reports received	219
Observations for magnetic declination received.....	1,295
Preliminary township plans prepared.....	371
Sketches made	7,971
Maps and tracings made	236
Plans of Yukon lots received.....	20
Plans of miscellaneous Yukon surveys received.....	25
Returns of surveys examined—	
Township subdivision	729
Township outline	243
Road plans	405
Railway plans	36
Yukon lots	20
Miscellaneous Yukon surveys	25
Mineral claims	26
Timber berths	24
Correction and other miscellaneous surveys.....	95
Township plans compiled	97
Townsite settlement and other plans compiled.....	10
Proofs of plans examined	42
Township plans printed	910
Townsite and settlement plans printed.....	13
Miscellaneous plans printed	151
Descriptions written.....	12
Areas calculated	394
Pages of field notes copied.....	386
Applications for various information dealt with.....	2,446
Files received and returned	1,734
Letters and memoranda drafted	11,964
Books received from Record Office and used in connection with office work	5,712
Books returned to Record Office.....	5,068
Plans other than printed township plans received from Record Office and used in connection with office work.....	944
Plans returned to Record Office.....	537
Volumes of plans received from Record Office and used in connection with office work	53
Volumes of plans returned to Record Office.....	52
Books sent to Record Office to be placed on record.....	549
Plans other than township plans sent to Record Office to be placed on record	105
Sectional maps (3 miles to 1 inch)—	
Revised and reprinted	25
Reprinted but not revised	7
New maps compiled and printed.....	9
Sectional maps (6 miles to 1 inch)—	
Reprinted	59
New maps printed	9

SESSIONAL PAPER No. 25b

APPENDIX No. 6

LIST of New Editions of Sectional Maps compiled from April 1, 1913, to March 31, 1914.

Scale, 3 miles to 1-inch.

No.	Name.	No.	Name.
10	Port Moody.	216	Sullivan Lake.
11	Yale.	220	Nut Mountain.
15	Lethbridge.	264	Brazeau.
18	Wood Mountain.	266	Ribstone Creek.
21	Turtle Mountain.	269	Prince Albert South.
22	Dufferin.	270	Pasquia.
23	Emerson.	313	Brulé.
61	Lytton.	315	Edmonton.
65	Macleod.	320	Carrot River.
68	Swift Current.	363	Baptiste.
71	Brandon.	413	Iosegun.
72	Portage la Prairie.	414	Saulteux.
73	Winnipeg.	415	Tawatinaw.
119	Regina.	416	Moberly.
120	Qu'Appelle.	463	Smoky River.
121	Riding Mountain.	465	Pelican.
122	Manitoba House.	466	Landels.
163	Donald.	511	St. John.
165	Rosebud.	512	Montagneuse.
170	Yorkton.	516	McMurray.
214	Rocky Mountain House.		

Scale, 6 miles to 1-inch.

No.	Name.	No.	Name.	No.	Name.
10	Port Moody.	120	Qu'Appelle.	270	Pasquia.
11	Yale.	121	Riding Mountain.	313	Brulé.
14	Pincer Creek.	122	Manitoba House.	314	St. Ann.
15	Lethbridge.	163	Donald.	315	Edmonton.
18	Wood Mountain.	164	Morley.	320	Carrot River.
21	Turtle Mountain.	165	Rosebud.	363	Baptiste.
22	Dufferin.	166	Sounding Creek.	364	Ft. Assiniboine.
23	Emerson.	168	Tim. Hillier.	365	Victoria.
24	Lake of the Woods.	170	Yorkton.	366	Saddle Lake.
61	Lytton.	171	Duck Mountain.	367	Meadow Lake.
65	Macleod.	214	Rocky Mountain House.	368	Green Lake.
66	Medicine Hat.	215	Red Deer.	413	Iosegun.
68	Swift Current.	216	Sullivan Lake.	414	Saulteux.
69	Moosejaw.	219	Humboldt.	415	Tawatinaw.
70	Moose Mountain.	220	Nut Mountain.	416	La Biche.
71	Brandon.	262	Yellowhead.	417	Moberly.
72	Portage la Prairie.	263	Jasper.	463	Smoky River.
73	Winnipeg.	264	Brazeau.	464	Giroux.
74	Cross Lake.	265	Peace Hills.	465	Pelican.
114	Calgary.	266	Ribstone Creek.	466	Landels.
115	Blackfoot.	267	Battleford.	511	St. John.
118	Rush Lake.	269	Prince Albert South.	512	Montagneuse.
119	Regina.			516	McMurray.

APPENDIX No. 7.

STATEMENT of work executed in the Photographic Office from April 1, 1913 to March 31, 1914.

	3½ x 3½	3½ x 5½	5 x 7	8 x 10	10 x 12	11 x 14	15 x 18	16 x 18	18 x 20	20 x 24	24 x 32	25 x 35	30 x 36	36 x 42	42 x 48	Total.
Dry plates and films	22	952	1,012	2	.....	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	2,022
Bromide prints	.....	.....	44	148	615	1,492	.....	254	220	101	22	.....	75	65	85	3,118
Sodio	.....	.....	1,019	222	.....	7	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,248
Velox	212	8,583	5,300	389	.....	52	.....	.....	.....	.....	.....	.....	.....	.....	.....	14,536
Artur	.....	.....	.....	13	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	13
Vandyke	.....	.....	1	19	8	127	.....	66	140	77	98	.....	140	109	141	929
Blue	.....	.....	8	54	25	313	.....	326	117	197	228	.....	260	200	85	1,813
Lantern slides	148	.....	.....	.....	.....	.....	.....	16	8	2	.....	.....	.....	.....	.....	148
Photographs mounted	.....	.....	157	265	.....	.....	.....	.....	200	57	51	.....	.....	.....	.....	418
Wet plate negatives	.....	.....	.....	156	.....	292	1,271	.....	125	20	.....	.....	.....	.....	.....	2,027
Photo-litho plates	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5	653	.....	.....	803
	382	9,535	7,574	1,268	618	2,287	1,271	659	810	454	309	5	1,128	374	311	27,105

SESSIONAL PAPER No. 25b

APPENDIX No. 8.

STATEMENT of work executed in the Lithographic Office from April 1, 1913, to March 31, 1914.

Month.	MAPS			TOWNSHIP PLANS.			FORMS		
	No.	Copies.	Impressions.	No.	Copies.	Impressions.	No.	Copies.	Impressions.
1913.									
April.....	8	1,325	2,150	58	11,000	12,400	7	5,275	5,275
May.....	15	4,800	5,475	65	13,000	13,000	8	5,341	5,341
June..	8	3,500	3,500	59	11,800	12,000			
July ..	3	925	600	28	5,600	5,800	5	3,000	3,000
August.....	7	16,875	70,775	36	7,200	7,200	3	1,650	1,650
September.....	11	15,925	63,250	72	14,400	14,600	4	3,500	3,500
October	54	23,425	21,925	45	8,600	8,600	5	1,600	1,600
November.....	45	18,925	19,650	84	16,800	17,000	7	9,100	10,300
December.....	9	3,375	3,525	64	12,800	12,800	3	3,500	3,500
1914.									
January	17	27,540	71,550	174	31,800	35,400	4	8,750	8,750
February.....	14	28,380	97,725	142	24,300	24,500	2	600	600
March.....	15	2,810	4,935	85	17,000	24,600	10	26,200	26,200
Total.....	206	147,105	372,860	910	177,900	188,000	56	100,716	101,916

RECAPITULATION.

	No.	Copies.	Impressions.	Cost.
Maps	206	147,105	372,860	3,425 74
Townships	910	177,900	188,000	3,776 00
Forms.....	56	100,716	101,916	927 76
Grand total	1,172	425,721	662,776	8,129 50

NOTE.—In the above schedule, the figures given for "cost" cover only the wages of the lithographers and printers: they do not include the cost of paper, machinery, supplies, rent, etc.

APPENDIX No. 9.

LIST OF EMPLOYEES of the Topographical Surveys Branch at Ottawa, on April 1, 1914, with the name, classification, duties of office and salary of each. (Metcalf street, corner of Slater.)

NAME.	CLASSIFICATION.		Duties of Office.	Salary.
	Division.	Sub-division.		
				\$
Deville, E., D.T.S., LL.D.	1	A	Surveyor General.	3,950
Shanks, T., B.A.Sc., D.L.S.	1	A	Asst. Surveyor General.	2,800
			Correspondence.	
Brady, M.	1	B	Secretary	2,600
Cullen, M. J.	3	A	Clerk.	1,200
Moran, J. F.	3	A	"	1,050
Williams, E. R.	3	A	"	1,050
Addison, W. G.	3	A	Stenographer.	950
Renault, J. F.	3	B	"	750
Pegg, A.			Messenger.	800
O'Meara, M. T.			"	650
			Accounts.	
Hunter, R. H.	2	A	Accountant	2,100
Lemay, A.	2	A	Asst. Accountant.	1,650
McPhail, N. R.	2	B	"	1,000
			Field work.	
Brown, T. E., B.A.	1	B	Supervisor of field work.	2,750

DIVISION I.

Survey Instructions and General Information.

Barber, H. G., Grad. S.P.S.	1	B	Chief of division	2,200
Rice, F. W., Grad. School of Mining	2	A	Technical clerk	2,000
MacIlquham, W. L., B.Sc.	2	A	"	2,000
Weld, W. F.	2	A	"	2,000
Peaker, W. J., Grad. S.P.S.	2	A	"	1,700
Carroll, M. J., Grad. S.P.S.	2	A	"	1,700
Rochon, E. C.	2	A	"	1,650
McRae, A. D., B.A., B.Sc.	2	A	Supply clerk	1,650
Grant, A. W., B.A.	2	A	Editor.	1,650
Hayward, H. E., B.Sc.	2	A	Registration clerk.	1,600
MacMillan, J. P., B.E.	2	B	Technical clerk.	1,400
Wadlin, L. N., B.Sc., D.L.S.	2	B	"	1,150
Gagnon, J. N. H., B.A.S.	2	B	"	1,150
Armstrong, W. B., B.Sc.	2	B	"	1,300
Nevins, L. A., B.A.	2	B	"	1,300
McDonald, J. F., B.A.	2	B	Registration clerk.	1,300
Sammon, J. J., B.A.	2	B	"	1,250
Fleming, A. C., B.A.	2	B	"	1,250
Quinlan, L. J., B.A.Sc.	2	B	Technical clerk	1,250
Lawrence, J., B.Sc.	2	B	"	1,200
Gallaher, O. G., B.Sc.	2	B	"	1,200
Miller, A. H., B.A.	2	B	"	1,200
Burkholder, E. L.	3	A	Clerk	1,050

SESSIONAL PAPER No. 25b

APPENDIX No. 9—Continued.

DIVISION II.

Examination of Survey Returns and Compilation of Plans.

Name.	Classification.		Duties of Office.	Salary.
	Division.	Sub-division.		
Nash, T. S., Grad. S.P.S., D.L.S.	1	B	Chief of division.	2,750
Dennis, E. M., B.Sc.	1	B	Survey examiner.	2,100
Hill, S. N., Grad. S.P.S.	1	B		2,100
Elder, A. J., Grad. S.P.S., D.L.S.	2	A		2,000
Genest, P. F. X., Q.L.S.	2	A		2,000
Kitto, F. H., D.L.S.	2	A	Director of surveys (Yukon)	1,700
McClennan, W. D.	2	A	Surveys examiner.	1,700
Roger, A., O.L.S.	2	A		1,700
Sutherland, H. E., B.Sc.	2	A		1,650
Ault, H. W.	2	A		1,650
Bray, R. P.	2	A	"	1,650
Spreckley, R. O.	2	A	"	1,600
Goodday, Leonard.	2	A	"	1,500
Harrison, E. W.	2	B		1,400
Lytle, W. J.	2	B	Recorder.	1,150
LaBeree, E. E.	2	B	Survey examiner.	1,150
Jones, G. S., Grad. S.P.S., O.L.S.	2	B		1,150
Bradley, J. D.	2	B	"	1,150
Kirwan, G. L., B.A.Sc.	2	B		1,250
Callender, R., B.Sc.	2	B		1,200
Cram, R. M., B.Sc.	2	B		1,200
Timbrell, E. G., B.Sc.	2	B	"	1,200
Macdonald, J. A.	3	B	Clerk.	800

DIVISION III.

Drafting and Printing, Imperial Building, Queen Street.

Engler, Carl., B.A., D.L.S.	1	B	Chief of division.	2,300
May, J. E.	2	A	Draughtsman.	2,000
O'Connell, J. R.	2	A	Draughtsman and engraver.	1,800
Moule, W. J.	2	B	Litho-designer.	1,600
Helmer, J. D.	2	B	Draughtsman.	1,200
Dawson, R. J.	2	B	Stamper.	1,200
Archambault, E.	2	B	Draughtsman and stamper.	1,200
Watters, James.	3	A	Printer.	1,200
McLennan, A. G.	3	A	Recorder.	1,200
Brown, A.	3	A	Stamper.	1,050
Ebbs, E. J.	3	A	"	1,050
Baril, C.	3	A	Clerk.	800

DIVISION IV.

British Columbia Surveys, Imperial Building, Queen Street.

Rowan-Legg, E. L.	2	A	Chief of division.	2,100
Gillmore, E. T. B., Grad. R.M.C.	2	A	Surveys examiner.	2,100
Morley, R. W.	2	A	"	2,000
Wilson, E. E. D., B.Sc.	2	A	"	1,750
Harris, K. D.	2	A	"	1,600

APPENDIX No. 9—Continued.

DIVISION V.

Mapping, Imperial Building, Queen Street.

NAME.	Classification.		Duties of Office.	Salary.
	1000s.	Sub-division.		
Smith, J.	1	B	Chief of division	2,750
Begin, P. A.	2	A	Draughtsman	2,000
Blanchet, A. E.	2	A		1,650
Côté, J. A., Grad. R.M.C.	2	A	Editor of reports.	1,750
D'Orsonnens, A.	2	A	Draughtsman	1,700
Flindt, A. H.	2	A		1,800
Davies, T. E. S.	2	A	Recorder	1,600
Purdy, W. A.	2	A	Draughtsman	1,600
Bergin, W.	2	B		1,200
Blanchard, J. F.	2	B	Technical Clerk	1,200
Colquhoun, G. A., B. Sc.	2	B		1,300
Davy, E.	2	B	Draughtsman	1,500
Howie, Jas.	2	B		1,150
Perrin, V.	2	B		1,600
Smith, R. L.	3	B	Technical Clerk	1,200
Villeneuve, E.	2	B	Draughtsman	1,200

DIVISION VI.

Special Surveys, Imperial Building, Queen Street.

Dodge, G. B., D.L.S.	1	B	Chief of division and Supt. Surveys Laboratory.	2,750
Watt, G. H., Grad. S.P.S., D.L.S.	2	A	Computer	2,000
Way, W. C., M.Sc.	2	A	Asst. Supt. Sur. Laboratory.	1,650
Milliken, J. B., B.A., B.Sc., D.L.S.	2	A	Examiner of baseline surveys.	1,600
Parry, H., B.Eng., D.L.S.	2	A	Mathematician	1,600
Wardle, J. M., B.Sc.	2	B	Laboratory assistant	1,250
Fredette, J. F., D.L.S.	2	B		1,200
Hughson, W. G., B.Sc.	2	B		1,250
Cannell, H. W., D.L.S.	2	B	Computer	1,250
Cousineau, A., B.Sc.	2	B		1,200
Herbert, W. H., B.Sc.	2	B		1,300
Roe, B. J.	2	B	Computer	1,250
Ross, R. C., B.Sc.	2	B		1,300
Lynch, F. J.	3	B	Stenographer	800
Watson, J. W.	3	B	Clerk	800
Pick, A. C.			Messenger	650

Chief Inspector of Surveys Office, 98 Wellington Street.

Hubbell, E. W., D.L.S.	1	B	Chief inspector	2,800
Sylvester, John	2	A	Assistant	1,800
Stalker, Miss M. W.	3	A	Stenographer	1,050

Board of Examiners for D.L.S.

Henderson, F. D., Grad. S.P.S., D.L.S.	1	B	Secretary	2,100
Nolan, Miss A. A.	3	B	Stenographer	500

SESSIONAL PAPER No. 25b

APPENDIX No. 9 *Continued.*

Geographic Branch, Woods Building, Slater Street.

Name.	Classification.		Duties.	Salaries.
	Division.	Sub-division.		
Whitcher, A. H., F.R.G.S., D.L.S.	2	A	Secretary.	2,700

Photographic Office, Metcalfe Street, corner Slater Street.

Carruthers, H. K.	2	A	Process photographer .	2,000
Woodruff, John.	2	A	Chief "	2,000
Collins, G. H. A.	2	B	Photographer.	1,000
Whitcomb, H. E.	3	A	"	1,200
Morgan, W. E.	3	A	"	1,200
Kilmartin, A.	3	A	Asst. photographer .	1,050
Ouimet, E. G.	3	B	"	900

Lithographic Office, Imperial Building, Queen Street.

Name.	Occupation.	Salaries.
Moody, A.	Foreman	\$27 00 per week.
Burnett, E.	Lithographer.	25 00
Thicke, C. R.	"	23 00
Deslauriers, J. H.	Transferrer.	20 00
Bergin, J.	Printer.	21 00
Thicke, H. S.	"	20 00
Boyle, S.	Stone polisher	15 00
Gagnon, J.	Press feeder ..	12 00
Kane, P.	"	9 50
Easton, R. M.	Printer.	19 50
Hare, E. H.	Asst. photographer.	15 00

APPENDIX No. 10.

LIST of Dominion Land Surveyors who are in possession of Standard Measures.

Name.	Address	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Akins, James Robert.....	Ottawa, Ont.....	Sept. 2, '76	Mar. 14, '10	
Allison, Calvin Bruce	South Woodslee, Ont.	June 16, '84	Mar. 28, '10	O.L.S.
Ashton, Arthur Ward.....	Ottawa, Ont.....	Nov. 5, '80	May 29, '08	B.C.L.S.
Austin, George Frederick	Not known.....		April 14, '72	
Aylen, John.....	North Bay, Ont.....		May 29, '85	
Aylsworth, Charles Fraser....	Madoc, Ont.....	April 21, '62	May 13, '86	O.L.S.
Baker, James Clarence.....	Vermilion, Alta....	May 12, '78	May 18, '06	A.L.S.
Baker, Mason Hermon.....	St. Thomas, Ont....	July 9, '84	Aug. 6, '08	O.L.S.
Bartlett, Ernest.....	Medicine Hat, Alta.	— '83	Jan. 16, '11	A.L.S.
Bayne, George A.....	Winnipeg, Man.....	Oct. 25, '50	April 14, '72	M.L.S.
Beatty, David.....	Parry Sound, Ont....	Dec. 22, '42	April 14, '72	O.L.S.
Begg, William Arthur.....	Hamilton, Ont.....	July 15, '82	June 8, '09	S.L.S.
Belanger, Phidime Roch Arthur	Ottawa, Ont.....	Mar. 5, '53	May 17, '89	Inspector of Surveys, Topographical Surveys Branch, Dept. of the In- terior.
Belleau, Joseph Alphonse.	Ottawa, Ont.....	Sept. 30, '56	May 15, '83	Land Patents Branch, De- partment of Interior.
Belyea, Albert Palmer Corey..	Edmonton, Alta		July 14, '09	A.L.S.
Bemister, George Bartlett....	Winnipeg, Man		June 11, '78	M.L.S. Engineering Dept. C.N.R.
Bennett, George Arthur.....	Ottawa, Ont.....	May 18, '86	Aug. 25, '10	A.L.S.
Berry, Edward Wilson.....	Seaforth, Ont.....	Aug. 26, '81	May 18, '11	
Bigger, Charles Albert	Ottawa, Ont	Aug. 15, '53	Mar. 30, '82	B.C.L.S., O.L.S., Assist- ant Superintendent Geodetic Survey.
Bingham, Edwin Ralph.....	Fort William, Ont..	— '78	Oct. 25, '06	O.L.S.
Blanchet, Guy Houghton.....	Ottawa, Ont.....	Feb. 12, '84	Mar. 10, '10	
Boivin, Elzear.....	Edmonton, Alta....	June 13, '57	Nov. 13, '83	
Boswell, Elias John.....	Montreal, Que....	Sept. 26, '70	Mar. 18, '03	O.L.S., M.L.S.
Boulton, William James.....	Wallaceburg, Ont..	Oct. 2, '84	Mar. 7, '12	
Bourgeault, Armand.....	St. Jean Port Joli, Que.....	Feb. 23, '58	Mar. 29, '83	Q.L.S.
Bourgault, Charles Eugene....	Lauzon, Levis, Que..	Sept. 6, '61	Feb. 21, '88	
Bourget, Charles Arthur.....	Lauzon, Que.....	Aug. 26, '51	May 14, '84	Q.L.S.
Bowman, Edgar Peterson.....	West Montrose, Ont.	Sept. 29, '83	Sept. 26, '07	O.L.S.
Bowman, Herbert Joseph	Berlin, Ont.....	June 18, '65	Feb. 16, '88	O.L.S.
Brabazon, Alfred James.....	Ottawa, Ont.....		May 13, '82	Boundary Surveys, Dept. of the Interior.
Bray, Samuel.....	Ottawa, Ont.....	Nov. 5, '46	Nov. 14, '83	O.L.S., Chief Surveyor, Dept. of Indian Affairs.
Bray, Lennox Thomas	Edmonton, Alta....	Mar. 14, '77	Feb. 18, '03	O.L.S., A.L.S.
Brenot, Lucien.....	Ottawa, Ont.....	Aug. 31, '87	Mar. 18, '10	
Bridgland, Morrison Parsons...	Calgary, Alta.....	Dec. 20, '78	Mar. 10, '05	A.L.S.
Broughton, George Henry.....	Penticton, B.C....	Aug. 12, '86	June 3, '09	B.C.L.S.
Brown, Charles Dudley.....	Winnipeg, Man.....	Feb. 25, '83	April 4, '10	A.L.S., S.L.S.
Brown, Edgar Carl.....	Winnipeg, Man.....	Nov. 28, '86	May 23, '11	A.L.S., S.L.S.
Brown, Thomas Wood.....	Saskatoon, Sask....	Nov. 10, '79	June 21, '09	A.L.S., S.L.S.
Brownlee, James Harrison....	Vancouver, B.C....	Mar. 22, '56	April 15, '87	M.L.S., B.C.L.S.
Buchanan, John Alexander...	Edmonton, Alta....	Mar. 4, '87	May 17, '12	A.L.S.
Burd, James Henry.....	Weyburn, Sask.....	Sept. 7, '71	May 18, '11	O.L.S., S.L.S.
Burgess, Edward LeRoy	Kamloops, B.C....	May 5, '78	Feb. 23, '05	O.L.S.
Burnet, Hugh.....	Victoria, B.C.....		June 22, '85	O.L.S., B.C.L.S.
Burwash, Nathaniel Alfred...	Toronto, Ont.....	Sept. 28, '79	Mar. 6, '07	O.L.S.
Burwell, Herbert Mahlon....	Vancouver, B.C....	Oct. 23, '63	Feb. 17, '87	B.C.L.S.
Calder, John Alexander.....	Lytton, B.C.....	June 2, '86	May 21, '12	
Cameron, Charles Scott.....	Beaverton, Ont.....	Dec. 6, '84	Mar. 15, '13	
Campbell, Alan John.....	Sidney, B.C.....	Oct. 1, '82	April 13, '09	B.C.L.S., A.L.S.
Campbell, Alexander Stewart..	Kingston, Ont.....	Mar. 7, '89	Mar. 6, '09	O.L.S.
Carbert, Joseph Alfred	Medicine Hat, Alta.	Feb. 4, '56	May 12, '80	O.L.S., A.L.S., District Engineer and Surveyor, Dept. of Public Works, Alberta.
Carpenter Henry Stanley.....	Regina, Sask.....	Feb. 8, '74	Feb. 20, '01	O.L.S., S.L.S., Depart- ment of Public Works
Carrall, Cyrus	Regina, Sask.....	Dec. 6, '34	April 14, '72	O.L.S., S.L.S.

SESSIONAL PAPER No. 25b

APPENDIX No. 10—*Continued.*LIST of Dominion Land Surveyors who are in possession of Standard Measures.—
Continued.

Name.	Address.	Date of Birth.	Date of Appointment or Commission.	Remarks.
Carson, Percy Alexander.....	Calgary, Alta....	Dec. 25, '77	Feb. 22, '06	Hydrographic Survey.
Carthew, William Morden.....	Edmonton, Alta. . .	Oct. 19, '86	Mar. 29, '10	A.L.S.
Carthew, John Trewalla.	Edmonton, Alta. . .	Feb. 15, '91	Mar. 15, '13	
Cautley, Reginald Hutton.....	Edmonton, Alta. . .	Dec. 6, '79	May 1, '05	A.L.S.
Cautley, Richard William.....	Edmonton, Alta. . .	Aug. 3, '73	Sept. 2, '96	A.L.S.
Cavana, Allan George.....	Orillia, Ont.	Jan. 22, '58	Nov. 16, '76	O.L.S.
Charlesworth, Lionel Clare...	Edmonton, Alta. . .	Nov. 17, '73	Mar. 24, '03	O.L.S., A.L.S., Dept. of Public Works, Alberta.
Chase, Albert Victor.....	Orillia, Ont.	Mar. 4, '83	Oct. 11, '10	O.L.S.
Chilver, Charles Alonzo. . . .	Walkerville, Ont....	Feb. 8, '83	Feb. 22, '07	
Christie, William.....	Prince Albert, Sask	Feb. 13, '76	Mar. 22, '06	S.L.S.
Clarke, Frederick Fieldhouse..	Toronto, Ont.	Aug. 22, '78	Feb. 18, '08	O.L.S.
Clarke, Charles Wentworth....	Regina, Sask. . . .	Nov. 19, '75	Mar. 21, '10	S.L.S.
Cleveland, Ernest Albert.....	Vancouver, B.C....	May 12, '74	June 27, '93	B.C.L.S.
Coates, Preston Charles.....	Victoria, B.C.	May 16, '81	April 19, '07	B.C.L.S.
Cokely, Leroy S.....	Duncan, B.C.	Nov. 23, '84	Mar. 22, '10	B.C.L.S.
Coltham, George William.	Aurora, Ont.	Feb. 19, '89	Mar. 15, '13	O.L.S.
Cond, Fritz Thomas Piercy...	Vancouver, B.C....	May 16, '86	May 18, '11	B.C.L.S.
Côté, Joseph Adélarde.....	Prince Albert, Sask	June 5, '64	May 14, '84	S.L.S.
Côté, Jean Léon.	Edmonton, Alta....	May 6, '67	Mar. 21, '90	A.L.S.
Côte, Joseph Martial.....	Ottawa, Ont.	Aug. 2, '89	May 13, '13	
Cotton, Arthur Frederick.....	Massett, B.C.	Aug. 8, '72	May 11, '80	O.L.S., B.C.L.S.
Cowper, George Constable.....	Welland, Ont.	Oct. 20, '86	Mar. 11, '11	
Craig, John Davidson.....	Ottawa, Ont.	Jan. 30, '76	Feb. 24, '02	Boundary Surveys, Dept. of the Interior.
Cumming, Austin Lewis . . .	Edmonton, Alta....	Aug. 25, '82	Feb. 3, '10	A.L.S.
Cummings, Alfred.....	Fernie, B.C.	July 3, '80	Mar. 3, '09	B.C.L.S.
Cummings, John George . . .	Cranbrook, B.C....	Nov. 19, '73	Feb. 17, '04	B.C.L.S.
Dalton, John Joseph.....	Weston, Ont.	June 12, '54	Apr. 17, '79	O.L.S., D.T.S.
Davies, Thomas Attwood.....	Edmonton, Alta....		Feb. 22, '06	A.L.S.
Dawson, Frederick James.....	Kamloops, B.C. . . .	Sept. 22, '86	Sept. 12, '10	B.C.L.S.
Day, Harry Samuel.....	Edmonton, Alta....	Nov. 14, '85	Mar. 9, '10	A.L.S.
Deans, William James.....	Brandon, Man....	May 1, '69	May 13, '86	O.L.S.
de la Condamine, C.....	Calgary, Alta....	Feb. 13, '75	May 4, '10	A.L.S.
Dennis, John Stoughton . . .	Calgary, Alta....	Oct. 22, '56	Nov. 19, '77	D.T.S.
Denny, Herbert C.	Not known.		Apr. 4, '82	
Dickson, Henry Godkin	Whitehorse, Y.T....	Mar. 29, '64	Mar. 19, '89	M.L.S.
Dickson, James	Fenelon Falls, Ont..	Oct. 30, '54	Apr. 14, '72	O.L.S.
Dobie, James Samuel	Thessalon, Ont.	Oct. 15, '73	Mar. 22, '06	O.L.S.
Donnelly, Cecil	Winnipeg, Man....	Oct. 18, '89	Mar. 15, '13	M.L.S.
Doupe, Jacob Lonsdale.....	Winnipeg, Man....	Sept. 14, '67	Oct. 6, '88	M.L.S., A.L.S., S.L.S., Asst. Land Commissioner for C.P.R.
Drewry, William Stewart . . .	Victoria, B.C.	Jan. 20, '59	Nov. 14, '83	O.L.S., B.C.L.S.
Driscoll, Alfred.....	Edmonton, Alta....	July 2, '65	Feb. 23, '87	B.C.L.S., A.L.S.
Drummond, Thomas.....	Montreal, P.Q....	1856	June 24, '78	D.T.S.
Duc, William A.	Winnipeg, Man....	April 4, '52	Mar. 30, '83	O.L.S., M.L.S.
Dumais, Paul T. Concorde . . .	Hull, P.Q.	Jan. 2, '47	Mar. 29, '82	O.L.S.
Earle, Wallace Sinclair.....	Vancouver, B.C....	Feb. 8, '89	May 18, '11	B.C.L.S., O.L.S.
Edwards, George.	Ponoka, Alta. . . .	June 13, '42	Apr. 14, '72	O.L.S., A.L.S.
Edwards, William Milton.....	Lethbridge, Alta....	June 21, '79	Apr. 5, '10	A.L.S.
Ellacott, Charles Herbert.....	Victoria, B.C. . . .	Dec. 24, '66	Feb. 22, '90	B.C.L.S.
Ellis, Douglas Stewart.....	Kingston, Ont.	Mar. 16, '85	May 17, '12	
Empey, John Morgan.....	Calgary, Alta....	Apr. 16, '74	Feb. 23, '05	O.L.S., A.L.S.
Engler, Carl.....	Ottawa, Ont.	Sept. 30, '72	Feb. 23, '05	T. S. Branch, Dept. of Interior.
Evans, Stanley Livingstone....	Corinth, Ont.	Jan. 14, '84	Feb. 13, '11	
Fairchild, Charles Courtland.	Edmonton, Alta....	Feb. 21, '67	Feb. 20, '01	O.L.S., A.L.S.
Farncomb, Alfred Ernest.....	Edmonton (South) Alta.	May 22, '73	Mar. 12, '02	O.L.S., A.L.S.
Fawcett, Adam.	Gravenhurst, Ont..		Feb. 22, '93	
Fawcett, Sydney Dawson.....	Ottawa, Ont.	Oct. 29, '82	May 18, '11	
Fawcett, Thomas.....	Ottawa, Ont.	Oct. 28, '48	Nov. 18, '76	O.L.S., D.T.S., Boundary Surveys, Dept. of Interior.

APPENDIX No. 10—*Continued.*LIST of Dominion Land Surveyors who are in possession of Standard Measures—
Continued.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Ferguson, George Hendry.....	Toronto, Ont.....	Jan. 20, '83	June 2, '09	
Findlay, Allan.. .. .	Winnipeg, Man.....	Oct. 15, '80	Mar. 21, '08	M.L.S.
Fletcher, James Allan	Fletcher, Ont.....	Mar. 26, '89	May 18, '11	
Fontaine, Louis Elie.....	Levis, P.Q.....	Oct. 3, '68	Nov. 30, '92	A.L.S., Inspector of Surveys, Dept. of Interior.
Francis, John.....	Portage la Prairie, Man.....	Dec. 22, '52	June 17, '75	M.L.S.
Galletly, James Simpson	Brooklin, Ont.	Apr. 15, '88	May 18, '11	
Garden, James Ford.....	Vancouver, B.C.....	Feb. 19, '47	May 13, '80	B.C.L.S.
Garden, George H.....	Lethbridge, Alta....	.....	Apr. 14, '72	Deputy Surveyor for N.B.
Garden, Charles.....	Not known.....	.....	Apr. 14, '72	Deputy Surveyor for N.B.
Garner, Albert Coleman.....	Regina, Sask.	Sept. 6, '78	May 27, '07	S.L.S., A.L.S., Chief Surveyor Surveys Branch Land Titles Offices.
Gauvreau, Louis Pierre	Not known .....	.....	Apr. 14, '72	
Gibbon, James.....	Vancouver, B.C.....	June 25, '60	Feb. 12, '91	O.L.S.
Glover, Arthur Edward.....	Edmonton, Alta....	Mar. 4, '87	Mar. 11, '11	A.L.S., S.L.S.
Gordon, Maitland Lockhart...	Vancouver, B.C.....	Sept. 27, '82	Feb. 18, '04	B.C.L.S.
Gordon, Robert John... ..	Lethbridge, Alta....	June 18, '69	Mar. 12, '02	A.L.S.
Gore, Thomas Sinclair	Victoria, B.C. ....	... 1852	Apr. 19, '79	B.C.L.S.
Graham, John Robertson.....	Vancouver, B.C.....	Apr. 18, '87	May 26, '10	B.C.L.S.
Grassie, Charles Andrew.....	Medicine Hat, Alta.	Dec. 24, '83	Dec. 27, '10	A.L.S.
Gray, James Edward	Edmonton, Alta....	Oct. 12, '81	Mar. 11, '11	A.L.S., S.L.S.
Green, Alfred Harold.....	Nelson, B.C.....	Jan. 20, '79	Feb. 23, '05	B.C.L.S., A.L.S.
Green, Thomas Daniel... ..	Rocky Mountain House, Alta....	Dec. 21, '57	May 19, '84	O.L.S.
Green, Frank Compton.....	Victoria, B.C.....	May 4, '73	May 8, '03	B.C.L.S.
Griffin, Albert Dyke.....	Elk Lake, Ont.....	Dec. 14, '60	May 13, '13	O.L.S.
Grover, George Alexander.....	Toronto, Ont.....	.....	Feb. 18, '04	
Haggen, Rupert Williams.....	Quesnel, B.C.	July 29, '87	May 18, '11	B.C.L.S.
Hamilton, Charles Thomas.....	Vancouver, B.C.....	July 29, '84	May 18, '11	B.C.L.S.
Hamilton, James Frederick...	Lethbridge, Alta....	April 4, '69	June 2, '09	A.L.S.
Harris, John Walter.....	Winnipeg, Man.....	Feb. 26, '45	April 14, '72	O.L.S., M.L.S., Assessment Commissioner and City Surveyor.
Harrison, Edward	Calgary, Alta. ....	.....	May 14, '10	A.L.S.
Harvey, Charles	Kelowna, B.C.....	May 5, '76	Feb. 17, '04	B.C.L.S.
Hawkins, Albert Howard.. ..	Listowel, Ont.....	July 27, '62	Mar. 6, '06	
Heaman, John Andrew	Winnipeg, Man.....	June 3, '75	July 15, '09	O.L.S.
Heathcott, Robert Vernon ..	Edmonton, Alta....	July 7, '81	May 13, '07	A.L.S.
Henderson, Walter.....	Not known.....	.....	Nov. 17, '83	
Herriot, George Henry.....	Souris, Man.....	Feb. 23, '83	Sept. 18, '09	M.L.S.
Heuperman, Frederick Justinus	Calgary, Alta....	July 23, '87	Mar. 13, '11	A.L.S.
Heuperman, Lambertus Fred..	Calgary, Alta....	Sept. 20, '81	Mar. 29, '10	A.L.S.
Hoar, Charles Millard.....	Calgary, Alta....	Sept. 26, '85	Mar. 9, '11	A.L.S.
Hobbs, Wilfrid Ernest.....	Winnipeg, Man.	Mar. 12, '87	Mar. 5, '12	M.L.S.
Holcroft, Herbert Spencer.....	Toronto, Ont.....	Sept. 4, '77	Feb. 18, '03	O.L.S.
Hopkins, Marshall Willard.....	Edmonton, Alta....	May 24, '61	Feb. 20, '01	O.L.S., A.L.S.
Hubbell, Ernest Wilson.....	Ottawa, Ont.....	Nov. 5, '62	May 19, '84	Chief Inspector of Surveys, Dept. of Interior.
Hunter, Albert Ernest.....	Warton, Ont.....	Nov. 8, '87	Mar. 7, '12	
Inkster, Oluff.....	Edmonton, Alta....	Mar. 25, '85	May 18, '11	A.L.S.
Jackson, John Edwin.....	Hamilton, Ont.....	Dec. 27, '81	May 18, '11	O.L.S.
James, Silas.....	Toronto, Ont.....	June 19, '34	April 14, '72	O.L.S.
Jephson, Richard Jermy	Brandon, Man.....	Feb. 5, '54	May 12, '80	O.L.S., B.C.L.S., M.L.S.
Johnson, Alfred William.....	Kamloops, B.C.....	Feb. 23, '74	Mar. 12, '02	B.C.L.S.
Johnson, Percy Nowell.....	Edmonton, Alta....	Oct. 4, '75	May 10, '09	
Johnston, James Homer.....	Edmonton, Alta....	Aug. 23, '87	May 17, '12	A.L.S.
Johnson, William James	St. Catharines, Ont..	Jan. 31, '81	Mar. 11, '11	
Keith, Homer Pasha	Edmonton, Alta....	Aug. 30, '85	Feb. 1, '11	A.L.S.
Kimpe, Maurice	Edmonton, Alta....	Jan. 17, '76	May 13, '07	A.L.S.
King, William Frederick.....	Dominion Observatory, Ottawa, Ont.	Feb. 19, '54	Nov. 21, '76	D.T.S. Chief Astronomer, Dept. of Interior.

SESSIONAL PAPER No. 25b

APPENDIX No. 10—*Continued.*LIST of Dominion Land Surveyors who are in possession of Standard Measures—
Continued.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Kirk, John Albert.....	Summerland, B.C....	Jan. 9, '54	May 11, '80	O.L.S., B.C.L.S.
Kitto, Franklin Hugo.....	Dawson, Y.T.....	Mar. 28, '80	Mar. 6, '08	
Klotz, Otto Julius.....	Dominion Observatory, Ottawa, Ont.	Mar. 31, '52	Nov. 19, '77	O.L.S., D.T.S., Astronomer, Dept. of Interior.
Knight, Richard H.....	Edmonton, Alta....	June 7, '77	Feb. 18, '04	A.L.S.
Lamb, Frederick Carlyle....	Saskatoon, Sask....	Dec. 11, '88	May 17, '12	
Lang, John Leiper.....	Sault Ste. Marie, Ont	Aug. 18, '84	Oct. 14, '08	O.L.S.
Latimer, Frank Herbert.....	Penticton, B.C.....	May 23, '60	Nov. 13, '85	B.C.L.S.
Laurie, Richard C.....	Battleford, Sask....	Jan. 31, '58	April 27, '83	S.L.S.
Leblanc, Pierre Maxime Henri	Ottawa, Ont.....	Oct. 1, '84	May 13, '13	
Lemoine, Charles Errol.....	Ville Montcalm, P.Q.		Mar. 31, '82	Q.L.S.
Lighthall, Abram.....	Vancouver, B.C.....	Mar. 30, '78	Dec. 25, '09	
Lindsay, James Herbert.....	Prince Albert, Sask.	Nov. 27, '82	May 18, '11	S.L.S.
Lonergan, Gerald Joseph....	Buckingham, P.Q....	Oct. 8, '71	Feb. 28, '01	Q.L.S., A.L.S., Inspector of Surveys, Dept. of Interior.
Loucks, Roy Wm. Egbert.....	Saskatoon, Sask....	Oct. 31, '84	Mar. 1, '12	A.L.S., S.L.S.
Lumsden, Hugh David.....	St. Andrews, N.B....	Sept. 7, '44	April 14, '72	O.L.S.
Macdonald, Colin Stone.....	Ottawa, Ont.....	May 26, '87	Mar. 10, '14	
Macdonald, Gordon Alexander.	Muirkirk, Ont....	May 24, '85	May 17, '12	B.C.L.S.
MacLennan, Alexander L....	Toronto, Ont.....	May 10, '78	Feb. 23, '05	S.L.S.
MacLeod, George Waters.....	Edmonton, Alta....	—	Mar. 1, '12	A.L.S.
MacPherson, Charles Wilfrid..	Dawson, Y.T.....	Sept. 6, '71	Mar. 7, '00	O.L.S.
Magrath, Charles Alexander..	Ottawa, Ont.....	April 22, '60	Nov. 16, '81	O.L.S., B.C.L.S., D.T.S., Member International Waterways Commission.
Martindale, Ernest Smith.....	Kingsmill, Ont....	May 20, '86	Mar. 11, '11	
Martyn, Oscar William.....	Regina, Sask....	Dec. 2, '88	Mar. 11, '11	S.L.S.
Matheson, Hugh.....	Ottawa, Ont.....	May 2, '79	May 9, '11	
McArthur, James Joseph.....	Ottawa, Ont.....	May 9, '56	April 17, '79	Boundary Surveys, Dept. of Interior.
McCaw, Robert Daniel.....	Sidney, B.C.....	May 24, '83	Mar. 23, '09	O.L.S., B.C.L.S., A.L.S.
McColl, Gilbert Beebe.....	Winnipeg, Man....	Oct. 8, '82	Mar. 20, '07	M.L.S., D.T.S.
McColl, Samuel Ebenezer....	Winnipeg, Man....	July 17, '86	May 18, '11	M.L.S.
McDiarmid, Stuart Stanley....	Vancouver, B.C....	Aug. 4, '81	Feb. 23, '05	B.C.L.S.
McDonald, Harold French....	Winnipeg, Man....	Nov. 22, '85	Mar. 3, '13	M.L.S., S.L.S., A.L.S.
McElhanney, Thomas Andrew.	Vancouver, B.C....	April 21, '86	Mar. 17, '12	
McEwen, Duncan Findlay....	Edmonton, Alta....	Aug. 7, '76	May 18, '11	A.L.S.
McFadden, Moses.....	Vancouver, B.C....	Aug. 26, '26	April 14, '72	O.L.S., M.L.S.
McFarlane, Walter Graham....	Peace River Landing, Alta.....	Sept. 28, '75	May 19, '05	A.L.S.
McFarlane, John Baird.....	Toronto, Ont....	Feb. 25, '79	June 3, '08	A.L.S.
McFee, Angus.....	Red Deer, Alta....	July 14, '46	April 19, '79	A.L.S.
McGeorge, William Graham....	Chatham, Ont....	Mar. 22, '87	Mar. 31, '10	O.L.S.
McGrandle, Hugh.....	Wetaskiwin, Alta....	Mar. 12, '57	Mar. 30, '83	O.L.S., A.L.S.
McKay, Robert B.....	Vancouver, B.C....	April 21, '83	May 21, '12	
McKnight, James Henry.....	Simcoe, Ont.....	July 13, '85	May 13, '13	
McLellan, Roy Alexander.....	Toronto, Ont.....	July 31, '89	Mar. 15, '13	
McMaster, William Angus Alexander	Prince Albert, Sask.	Feb. 1, '85	July 6, '10	A.L.S., S.L.S.
McMillan, George.....	Finch, Ont.....	Dec. 9, '69	Feb. 22, '06	
McNaughton, Alexander L....	Kelowna, B.C.....	Sept. 30, '81	Feb. 23, '05	O.L.S., B.C.L.S.
McPherson, Archibald John...	Regina, Sask.....	—	Feb. 21, '01	S.L.S.
McPhillips, Robert Charles....	Winnipeg, Man....	April 24, '56	May 17, '80	M.L.S.
McVittie, Archibald W.....	Victoria, B.C.....	May 5, '78	Mar. 30, '82	B.C.L.S.
Meadows, William Walter....	Maple Creek, Sask..	May 27, '75	Feb. 23, '05	O.L.S., S.L.S.
Melhuish, Paul.....	Vancouver, B.C....	April 14, '87	May 18, '11	B.C.L.S.
Miles, Charles Falconer....	Toronto, Ont.....	Jan. 30, '38	April 14, '72	O.L.S., Inspector of Surveys, Dept. of Interior.
Mitchell, Benjamin Foster....	Edmonton, Alta....	June 16, '80	April 16, '08	A.L.S.
Moberly, Harford Kenneth....	Yorkton, Sask....	—	April 21, '03	S.L.S.
Montgomery, Royal Harp....	Prince Albert, Sask.	May 20, '82	Feb. 23, '05	O.L.S., S.L.S.
Moore, Herbert Harrison....	Calgary, Alta.....	Dec. 1, '69	Feb. 17, '04	A.L.S.
Morrier, Joseph Eldedge.....	Prince Albert, Sask.	Aug. 29, '74	May 16, '07	S.L.S.

5 GEORGE V., A. 1915

APPENDIX No. 10—*Continued.*LIST of Dominion Land Surveyors who are in possession of Standard Measures—
Continued.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Remarks.
Murray, Ernest William	Regina, Sask.	Mar. 20, '84	May 31, '10	S.L.S.
Narraway, Athos Maxwell	Ottawa, Ont.	July 19, '88	May 18, '11	
Neelands, Rupert A.	Hamilton, Man.	Aug. 26, '84	Mar. 5, '12	
Nelles, Douglas Henry	Ottawa, Ont.	Mar. 26, '81	Mar. 9, '07	
Nesham, Edward Williams	Ottawa, Ont.	June 10, '88	Mar. 15, '13	
Neville, Everett A.	Vancouver, B.C.	Jan. 8, '87	May 18, '11	B.C.L.S.
O'Hara, Walter Francis	Ottawa, Ont.		Feb. 19, '95	O.L.S.
Ord, Lewis Redman	Hamilton, Ont.	Oct. 17, '56	April 1, '82	O.L.S.
Palmer, Philip Ebenezer	Dorchester, N.B.	May 6, '88	Mar. 7, '12	
Parsons, Johnstone Lindsay R.	Regina, Sask.	Jan. 18, '76	Feb. 23, '05	O.L.S., S.L.S.
Patrick, Allan Poyntz	Calgary, Alta.	July 18, '49	Nov. 19, '77	B.C.L.S., D.T.S., A.L.S.
Patten, Thaddeus James	Little Current, Ont.	Feb. 4, '59	Mar. 29, '83	O.L.S.
Pearce, William	Calgary, Alta.	Feb. 1, '48	May 10, '80	O.L.S., B.C.L.S., A.L.S.
Pearce, Seabury Kains	Calgary, Alta.	Dec. 6, '87	Mar. 9, '11	A.L.S.
Pearson, Hugh Edward	Edmonton, Alta.	Oct. 17, '87	May 17, '12	A.L.S.
Pequegnat, Marcel	Berlin, Ont.	April 27, '86	June 6, '10	O.L.S.
Peters, Frederic Hatheway	Calgary, Alta.	Nov. 4, '83	Mar. 4, '10	A.L.S., Com. of Irrigation
Phillips, Edward Horace	Saskatoon, Sask.	Dec. 19, '78	Feb. 24, '02	S.L.S.
Phillips, Harold Geoffrey	Regina, Sask.	Sept. 3, '87	April 22, '10	S.L.S.
Pierce, Benjamin Clifford	Kingston, Ont.	Nov. 5, '90	Mar. 13, '14	
Pierce, John Wesley	Ottawa, Ont.	July 14, '85	Dec. 24, '09	O.L.S.
Pinder, George Zouch	Edmonton, Alta.	Mar. 5, '81	Mar. 15, '13	
Plunkett, Thomas Hartley	Meaford, Ont.	June 1, '78	Mar. 12, '08	
Ponton, Archibald William	Edmonton, Alta.	Jan. 25, '59	May 18, '81	O.L.S., A.L.S.
Powell, William Henry	Vancouver, B.C.	Dec. 22, '84	Feb. 22, '11	B.C.L.S.
Proudfoot, Hume Blake	Prince Albert, Sask.	June 23, '58	Mar. 28, '82	O.L.S., S.L.S.
Purser, Ralph Clinton	Windsor, Ont.	April 7, '86	Feb. 2, '11	
Rainboth, Edward Joseph	Ottawa, Ont.		May 19, '81	Q.L.S., O.L.S.
Ransom, John Thomas	Toronto, Ont.	Aug. 24, '88	Jan. 14, '11	O.L.S.
Reilly, William Robinson	Regina, Sask.	Aug. 10, '57	Nov. 17, '81	O.L.S., M.L.S., S.L.S.
Richard, Joseph Francois	Ste. Anne de la Po-		May 13, '82	Q.L.S.
	catièrre, P.Q.			
Rinfret, Claude	Montreal, P.Q.	Jan. 5, '86	Mar. 20, '08	Q.L.S.
Rinfret, Raoul	Montreal, P.Q.	July 16, '56	Feb. 20, '00	Q.L.S.
Ritchie, Joseph Frederick	Prince Rupert, B.C.	May 23, '63	Jan. 7, '89	B.C.L.S.
Roberts, Sydney Archibald	Victoria, B.C.	April 10, '48	May 16, '85	B.C.L.S.
Roberts, Vaughan Maurice	Goderich, Ont.	Mar. 22, '64	May 17, '86	
Robertson, Donald Fraser	Ottawa, Ont.		May 25, '09	Dept. of Indian Affairs.
Robertson, Henry H.	N. Timiskaming, P.Q.	Sept. 13, '47	April 14, '72	Q.L.S.
Robertson, Edgar Doctor	Edmonton Alta.	Sept. 12, '85	Mar. 15, '13	
Robinson, Ernest Walter P.	Ottawa, Ont.	May 8, '80	May 1, '08	
Robinson, Franklin Joseph	Regina, Sask.	Oct. 20, '70	Feb. 20, '00	S.L.S., Deputy Minister of Public Works.
Robinson, William Andrew	Winnipeg, Man.	Feb. 21, '81	Oct. 2, '11	S.L.S., M.L.S.
Rolfson, Orville	Walkerville, Ont.	Feb. 26, '85	July 11, '08	
Rombough, Marshall Bedwell	Morden, Man.	Oct. 14, '35	April 14, '72	M.L.S.
Rorke, Louis Valentine	Toronto, Ont.	Feb. —, '65	Aug. 13, '91	O.L.S., Inspector of Surveys for Ontario.
Ross, George	Welland, Ont.	June 12, '53	Nov. 21, '82	O.L.S.
Ross, Joseph Edmund	Kamloops, B.C.	Jan. 9, '61	Feb. 12, '91	O.L.S., B.C.L.S.
Routly, Herbert Thomas	Toronto Ont.	Jan. 20, '78	Feb. 15, '11	O.L.S.
Roy, George Peter	Quebec, P.Q.	Oct. 1, '52	Nov. 17, '81	Q.L.S.
Roy, Joseph George Emile	Quebec, P.Q.	Mar. 14, '86	May 25, '10	Q.L.S.
Russell, Alexander Lord	Port Arthur, Ont.		April 14, '72	O.L.S.
Saint Cyr, Jean Baptiste	Montreal, P.Q.	Dec. 17, '66	Feb. 17, '87	Q.L.S.
Saint Cyr, Arthur	Ottawa, Ont.	Nov. —, '60	Feb. 17, '87	
Saunders, Bryce Johnston	Edmonton, Alta.	Oct. 17, '60	Nov. 16, '84	O.L.S.
Scott, Walter Alexander	Calgary, Alta.	Aug. 8, '85	Mar. 9, '09	A.L.S., S.L.S.
Seager, Edmund	Kenora, Ont.	Nov. 22, '38	April 14, '72	O.L.S.
Segré, Beresford Henry	Davidson, Sask.	Feb. 19, '86	May 8, '12	
Seibert, Frederick V.	Edmonton Alta.	Nov. 5, '85	Mar. 11, '11	O.L.S., S.L.S.
Sewell, Henry DeQuincy	Toronto, Ont.	April 18, '48	May 16, '85	O.L.S.
Seymour, Horace Llewellyn	Red Deer, Alta.	June 11, '82	Feb. 22, '06	O.L.S., A.L.S., S.L.S.

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APPENDIX No. 10—*Continued*List of Dominion Land Surveyors who are in possession of Standard Measures.
Concluded.

Name.	Address.	Date of Birth.	Date of Appointment or of Commission.	Honours.
Shaw, Charles Aeneas...	Greenwood, B.C.....	Nov. 16, '53	May 10, '80	O.L.S., B.C.L.S.
Shepley, Joseph Drummond	N. Battleford, Sask...	Sept. 13, '79	Mar. 12, '06	S.L.S.
Smith, Charles Campbell.....	Vancouver, B.C.....	Jan. 1, '73	Feb. 22, '06	O.L.S.
Smith Donald Alpine.....	Regina, Sask.....	Sept. 22, '80	April 21, '10	S.L.S.
Smith, James Herbert.....	Edmonton, Alta.....	Nov. 9, '76	Feb. 23, '05	A.L.S., O.L.S.
Soars, Henry Martin Robinson	Edmonton, Alta.....	April 22, '77	Nov. 2, '08	A.L.S.
Speight, Thomas Bailey.....	Toronto, Ont.....	Feb. 8, '59	Nov. 16, '82	O.L.S.
Starkey, Samuel M.....	Coltys, N.B.....	Sept. 4, '37	April 14, '72	P.L.S. for N.B.
Steele, Ira John.....	Ottawa, Ont.....	April 6, '81	April 16, '08	O.L.S. S.L.S.
Stewart, Elihu.....	Collingwood, Ont.....	Nov. 17, '44	April 14, '72	O.L.S.
Stewart, Lionel Douglas N.	Fort Frances, Ont.....	Sept. 15, '83	Jan. 27, '10	O.L.S.
Stewart, Will Malcolm.....	Saskatoon, Sask.....	Nov. 26, '81	Jan. 6, '07	S.L.S.
Stewart, Louis Beaufort.....	Toronto, Ont.....	Jan. 27, '61	Nov. 22, '82	O.L.S., D.T.S. Professor of Surveying and Geodesy, University of Toronto.
Stewart, Alexander George...	Edmonton, Alta.....	Aug. 16, '87	Mar. 14, '10	A.L.S.
Stewart, George Alexander...	.....	.....	April 14, '72	O.L.S.
Stewart, Norman C.....	Vancouver, B.C.....	Jan. 9, '85	March 7, '12	B.C.L.S.
Stock, James Joseph.....	Ottawa, Ont.....	Aug. 16, '87	March 2, '10	
Street, Paul Bishop.....	Toronto, Ont.....	Dec. 3, '81	Mar. 29, '10	
Stuart, Alexander Graham...	Buckingham, P.Q.....	July 16, '88	May 9, '11	
Summers, Gordon Foster.....	Halifax, N.S.....	.....	Oct. 20, '10	O.L.S.
Swannell, Frank Cyril.....	Victoria, B.C.....	.....	May 10, '04	B.C.L.S.
Taggart, Charles Henry ..	Kamloops, B.C.....	.....	'83 May 9, '11	
Talbot, Albert Charles...	Calgary, Alta.....	April 5, '56	May 13, '80	A.L.S.
Taylor, Alexander.....	Port Arthur, Man.....	Aug. 6, '75	June 9, '04	M.L.S., S.L.S.
Taylor, William Emerson...	Toronto, Ont.....	Aug. 3, '81	Dec. 16, '10	O.L.S.
Teasdale, Charles Montgomery	Moosejaw, Sask.....	Oct. 18, '79	March 9, '06	S.L.S.
Thompson, William Thomas..	Grenfell, Sask.....	Nov. 1, '53	Nov. 19, '77	D.T.S., S.L.S.
Tipper George Adrian.....	Brantford, Ont.....	July 25, '86	May 18, '11	A.L.S.
Tracy, Thomas Henry.....	Vancouver, B.C.....	June 25, '48	April 14, '72	O.L.S., B.C.L.S.
Tremblay, Alfred Joseph.....	Montmagny, P.Q.....	.....	Feb. 18, '90	
Tremblay, Albert Jacques...	Edmonton, Alta.....	July 25, '87	March 1, '12	A.L.S.
Turnbull, Thomas.....	Winnipeg, Man.....	May 26, '57	Mar. 29, '82	O.L.S.
Tyrrell, James William...	Hamilton, Ont.....	May 10, '63	Feb. 16, '87	O.L.S.
Underwood, Joseph Edwin...	Saskatoon, Sask.....	Nov. 3, '82	May 18, '11	S.L.S.
Van Skiver, Leighton A.....	Fish Lake, Ont.....	.....	'71 May 13, '13	
Vaughan, Josephus Wyatt...	Vancouver, B.C.....	Oct. 17, '45	Jan. 10, '78	B.C.L.S.
Vicars, John Richard Odium	Kamloops, B.C.....	April 16, '55	May 17, '86	O.L.S., B.C.L.S.
Vickers, Thomas Newell.....	N. Battleford, Sask...	April 19, '90	May 17, '12	S.L.S.
Von Edeskuty, Joseph Otto..	Vancouver, B.C.....	Oct. 27, '84	March 3, '13	
Waddell, William Henry.....	Edmonton, Alta.....	March 23, '83	Mar. 25, '07	O.L.S., A.L.S.
Waldron, John.....	Moosejaw, Sask.....	Aug. 1, '72	April 2, '07	S.L.S.
Walker, Claude Melville.....	Guelph, Ont.....	Oct. 16, '81	Mar. 11, '11	
Wallace, James Nevin.....	Calgary, Alta.....	Aug. 21, '70	Feb. 20, '00	O.L.S., A.L.S.
Warren, James.....	Walkerton, Ont.....	Nov. 7, '37	April 14, '72	O.L.S.
Warrington, George Albert...	Winnipeg, Man.....	.....	'85 Mar. 15, '13	M.L.S.
Watt, George Herbert.....	Ottawa, Ont.....	Feb. 5, '76	Feb. 24, '02	
Waugh, Bruce Wallace.....	Ottawa, Ont.....	March 24, '88	May 28, '12	
Weekes, Abel Seneca.....	Edmonton, Alta.....	Feb. 17, '66	Feb. 11, '92	A.L.S., S.L.S., O.L.S.
Weekes, Melville Bell.....	Regina, Sask.....	Nov. 28, '74	Feb. 18, '03	O.L.S., S.L.S.
Wheeler, Arthur Oliver.....	Sidney, B.C.....	May 1, '60	Nov. 21, '82	O.L.S., B.C.L.S., M.L.S., A.L.S.
White-Fraser, George W. R. M.	Victoria, B.C.....	.....	'61 Feb. 21, '88	D.T.S., B.C.L.S.
Wiggins, Thomas Henry.....	Saskatoon, Sask.....	Aug. 24, '63	Feb. 18, '96	O.L.S., S.L.S.
Wilkins, Frederick, W. B....	Norwood, Ont.....	June 27, '54	May 18, '81	O.L.S., D.T.S.
Wilkinson, William Downing	Hamilton, Bermuda...	Mar. 22, '64	Feb. 22, '03	
Williams, Guy Lorne.....	Enderby, B.C.....	March 3, '79	June 24, '08	B.C.L.S.
Wilson, Reginald Palliser...	Winnipeg, Man.....	July 9, '72	Jan. 26, '11	M.L.S.
Woods, Joseph Edward.....	Pincher Creek, Alta...	Oct. 13, '61	Nov. 14, '85	A.L.S.
Wrong, Frederick Hay.....	Windsor, Ont.....	Aug. 22, '86	May 18, '11	
Young, Stewart.....	Regina, Sask.....	Sept. 2, '84	May 17, '13	S.L.S.
Young Walter Beatty.....	Winnipeg, Man.....	July 6, '80	Mar. 25, '05	M.L.S.
Young William Howard.....	Calgary, Alta.....	June 8, '78	May 17, '07	A.L.S. District Engineer

REPORTS OF SURVEYORS.

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GENERAL REPORTS OF SURVEYORS

1913-1914

APPENDIX No. 11.

REPORT OF J. R. AKINS, D.L.S.

BASE LINE SURVEYS IN THE VALLEY OF PEACE RIVER.

OTTAWA, March 2, 1914.

E. DEVILLE, Esq., LL.D.,

Surveyor General,

Ottawa, Canada.

SIR,—I have the honour to submit the following report on the survey of the meridian outline between ranges 21 and 22, from the 23rd to the 24th bases and parts of the 24th, 25th, 26th, and 27th bases, all west of the fifth meridian.

I left Edmonton with my party on February 28, 1913, and reached Peace River Crossing on March 13. The route followed was by the Canadian Northern railway to Athabaska, up Athabaska river to Mirror landing, up Little Slave river and over the portage to Lesser Slave lake, across the lake to Grouard, and from there to Peace River Crossing by trail.

Hay was known to be very scarce along Peace river on account of the dry weather and fires during the previous season. It was therefore decided to haul the hay from Grouard, a distance of eighty-five miles. Most of the packhorses would work in harness, so when we were at Grouard, extra sleighs were purchased and used for freighting, each team hauling about a ton.

At Peace River Crossing arrangements were made with the Peace River Trading and Land company to have a scow ready to take supplies down stream to the work as soon as navigation should open. This scow was later used for moving the party and supplies between bases. In the fall it was brought up to the Crossing, loaded with supplies, horses, sleighs and oats and sent down to Vermilion. This scow was built very strongly with a flat bottom and square ends and carried about twelve tons.

In the meantime as the starting point of the work was about thirty-five miles down stream from Peace River Crossing, the outfit was hauled down the river and afterwards the teams were used hauling freight from the Crossing while the main party commenced work on the meridian outline which ran nearly parallel to the river and about five miles west of it. As the snow was still deep in the woods the cache was left on the river, and was moved down as the work proceeded.

As the line advanced trails were cut from the river to intersect it, and on these trails supplies were brought from the river to the camp. When the ice began to melt the cache was moved down to where the 24th base was expected to cross the river and placed on the east side of the river. All but ten of the horses were also put on the east side. This necessitated making two trips each day camp was moved while working west of the river, but it eliminated the risk of transportation being stopped by running ice when the survey of the 24th base line should reach the river. This proved to have been a wise precaution, for when the river was reached on April 19 the ice, although strong enough in the morning to chain over, broke up in the afternoon. The river was open along the west shore, and as the horses could not cross, a

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canoe was used to get the camp from the shore to the ice. Several men were engaged in getting it across when the ice began to move. They had considerable difficulty in getting the outfit off the moving ice, but nothing was lost. It is a fine sight to see the ice on those northern rivers go out. It is of great thickness and when a jam occurs great blocks roll up on the shore.

The northeast corner of township 92, range 18, was reached on May 5 with forty-nine miles of line run. Here we met Mr. J. A. Fletcher, D.L.S., with his party, and the two parties working together produced the meridian outline to the 25th base, where the parties separated. After twelve miles of this base had been run Peace river was reached again. The water was now very high and driftwood was running so thick that the Hudson's Bay company would not take the horses across in their boats. As the horses could not swim, the twelve miles on the west side of the river was done by man packing, after which the party was moved to the 26th base. When eighteen miles of this was run the outfit was again moved north and work commenced on the 27th base. I was instructed to run this line far enough west to establish a township corner on the west side of the river. One range was found sufficient for this, after which the line was produced eastward.

On receiving your telegram of August 6, stating that some of the horses should be wintered at Fort Vermilion, I endeavoured to get one of the settlers to take charge of them for the winter, but they claimed that it was too late in the season to get sufficient hay cured. I therefore hired a wagon, mowing machine and rake, and left a small party at Buffalo Head prairie to put up hay while the remainder continued on the line. On account of the wet fall weather and the short days considerable difficulty was found in curing the hay, but in about a month one hundred and thirty loads were gathered. The horses are wintering there, two men being in charge. They have built stables and a shack and by their latest reports the horses are doing well.

On September 26 we reached Wabiskaw river. Up to that time we had independently completed 147 miles of line. On the following day the party started for Fort Vermilion. Previous arrangements had been made with the Hudson's Bay company by which they promised to have their last boat leave Vermilion on October 1, that being the latest date on which they said they would risk starting up stream as they were afraid of meeting running ice. When the arrangement was made much stress was laid on the fact that they were not to keep us waiting. The later the appointed time of starting the better, if they were sure to start on the day appointed. I offered to contract with them that I would pay any expense which they would incur if I kept them waiting providing they would pay ours if we had to wait on them. They would not make this contract but assured us that they would leave at the time appointed. This trip was arranged especially for the surveyors in the country, we having guaranteed to give them a certain number of passengers and freight. But when we got to the Fort no boat had yet arrived. We waited four days and then decided that we would wait no longer as an accident might have happened to the boat, and if we stayed longer we might be unable to get out, which would place us in a serious position as there was only a limited amount of supplies.

A scow was fitted up, and on October 3 we started tracking up the Peace. On the 6th we met the boat coming down. Six days later it picked us up and we arrived at the Crossing on the 16th.

Owing to the wet season the trail to Grouard was in a very bad condition. As high as seven cents per pound was being paid to get freight across, and it was difficult to get freighters to make the trip. We were therefore fortunate in getting two teams to go the day after we arrived. The progress was very slow because of the mud and water. On the 21st information was received that the lake boat had just come to Grouard and would leave the following morning. If this boat was missed it would be about a week before another would leave, and if the weather turned cold we might not get one at all. It was therefore decided to travel at night and Grouard was reached

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at three o'clock in the morning. The boat transported the party to Soto landing. From there the party walked to Mirror landing, while the baggage was brought over in wagons. From Mirror landing to Athabaska the transportation was by scow. Edmonton was reached on October 28.

Route.

Settlers can get to Peace river any time of the year, but the month of March is the best. At that time of the year the trail is generally good and the weather not very cold. There are stopping-places all along the way which have bunk-houses for the travellers and stables and feed for the horses, but each person must carry his own blankets. At other times of the year the trails are often in a very bad condition, but it will only be a couple of years before the railroad will have reached Peace river.

In summer it is easy to get from Peace River Crossing to Fort Vermilion. A settler can build a raft, pile on his effects and quietly float for a distance of 330 miles, at a rate of from two and a half to four miles an hour. There are three ways of getting out from Fort Vermilion: (1) by boat, (2) by tracking up the river when the water is low, (3) by a pack trail which connects Fort Vermilion with the Crossing. This trail is on the northwest side of the river and is in places about forty miles from it.

There are two boats on the river: one owned by the Hudson's Bay company and one by the Peace River Trading and Land company. The latter company's boat was compelled to tie up the greater part of last summer on account of the boiler bursting. These boats run a freight and passenger service from Vermilion chutes to Hudson Hope. The following is the tariff:—

Distance in Miles.	From Vermilion chutes to	Freight Tariff per 100 lbs.		Passenger Tariff each person.	
		Up.	Down.	Up.	Down.
		\$ cts.	\$ cts.	\$ cts.	\$ cts.
50	Fort Vermilion	1 00	0 75	5 00	2 00
330	Peace River Crossing.	4 00	1 75	30 00	17 00
400	Dunvegan	5 00	2 50	40 00	22 00
530	Fort St. John.	7 00	4 00	55 00	32 00
570	Hudson Hope.	9 00	6 00	65 00	37 00
240	Chipewyan.	3 00	1 50	30 00	20 00

A good road would greatly assist in settling the country. A road from Athabaska via Wabiskaw to Fort Vermilion is now under consideration by the Provincial Government. If a road were built on the northwest side of the river from Peace River Crossing to Fort Vermilion it would make most of the good country accessible.

Description of Country.

Almost the entire valley of Peace river, consisting of a strip from thirty to sixty miles wide, is suitable for settlement. The west side of the river has the larger proportion of good soil. The land could be easily cleared as it is generally lightly wooded with spruce, poplar and scrub, and there are also many open patches which grow fine hay.

The 27th base enters a prairie in range 15. This prairie is not large but it grows an abundance of peavine and blue-joint which makes the best of horse feed, and there is no difficulty in cutting it with a machine. About one and a half miles south of the

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base in range 10, there is a much larger prairie, about four miles wide and twenty long. Between these two prairies the line passes through a peculiar country. When heavy rains fall much of it becomes flooded and large streams which have their source in the Buffalo Head hills suddenly spread all over the country. In the first part of their course they have well-marked channels but when they spread out there is no channel whatever. It was very disagreeable work running this part of the line as there had been heavy rains on the Buffalo Head hills and we had to work knee-deep in the cold water for several miles. A few miles north of the base line this water is all collected by Bear river. On the east side of Loon river there is little feed, the country being mostly covered with moss. A full description of the different parts of the country is shown on the sketch map which accompanies this report.

Resources.

Agriculture will probably be the chief industry of the country. Farming has been tried many places around Fort Vermilion with considerable success. Mr. S. Lawrence, who has been in the country for many years, finds farming a paying proposition. He has three hundred head of cattle, seventy-five horses and one hundred pigs. Last year he raised over three thousand bushels of wheat, besides oats and barley. He sells the wheat at one dollar and a half a bushel, and it is ground at the Fort. The Hudson's Bay company have a modern electrically lighted flour mill; the flour is either used in the vicinity or shipped to the northern ports.

The experimental farm in charge of Mr. Jones suggests wonderful possibilities for the country, and leads to the conclusion that it will be only a short time before the whole valley will be settled with prosperous farmers.

There were no minerals seen during the season except traces of gypsum.

There will be enough timber to supply the needs of the settlers but not enough to be of any commercial value.

Game.

Game is quite plentiful, moose abounding in the vicinity of the Buffalo Head hills. Bears are also plentiful, and in the fall many were seen along Peace river, where they come to look for berries. Prairie-chickens and several species of grouse were noticed, but they were not very plentiful.

Fur.

There are many fur-bearing animals in the country, consisting of foxes (black, silver, cross and red), mink, marten, weasels and some beavers. The last mentioned are not very numerous at present, but the work which they have left shows that they have been very plentiful in the past. On the Buffalo Head hills there are quite a few timber wolves, and in very severe winters these come down to the plains to look for food.

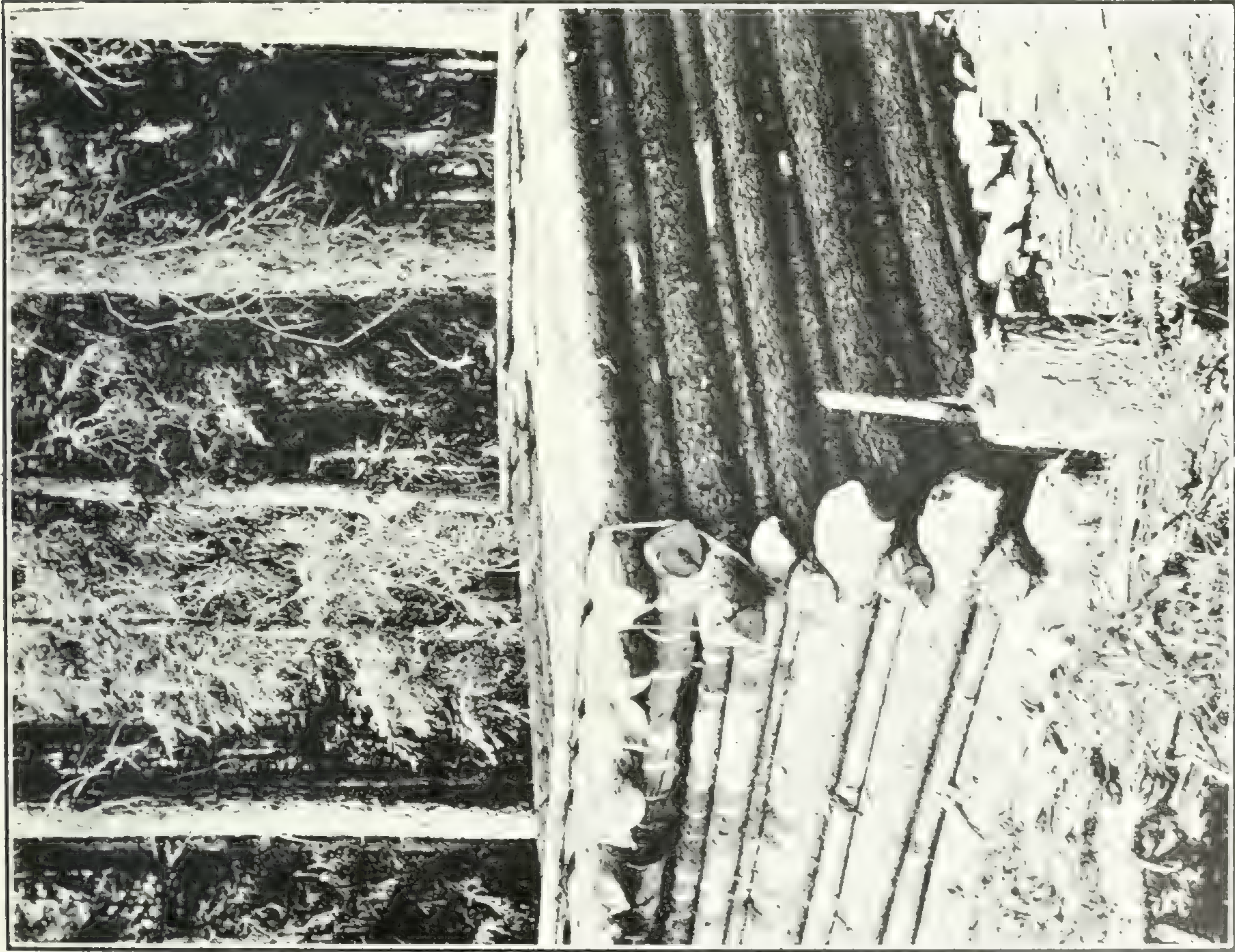


Photo by J. A. Fletcher, D. L. S.
Survey Cache on Peace River in Township 105.

The caches are built at convenient points, as near as possible to the place where the survey line will run. Supplies are then hauled in winter, when transportation is easiest, and deposited in these caches for use by the survey party when running the line. The floor of the cache consists of poles on which the supplies are laid, except the bacon which is always hung up. The walls are clinched and the supplies are covered with heavy canvas to keep off the rain. A covering of poles is then wired on to keep off bears and other predatory animals. Supplies are kept thus for months without being damaged.

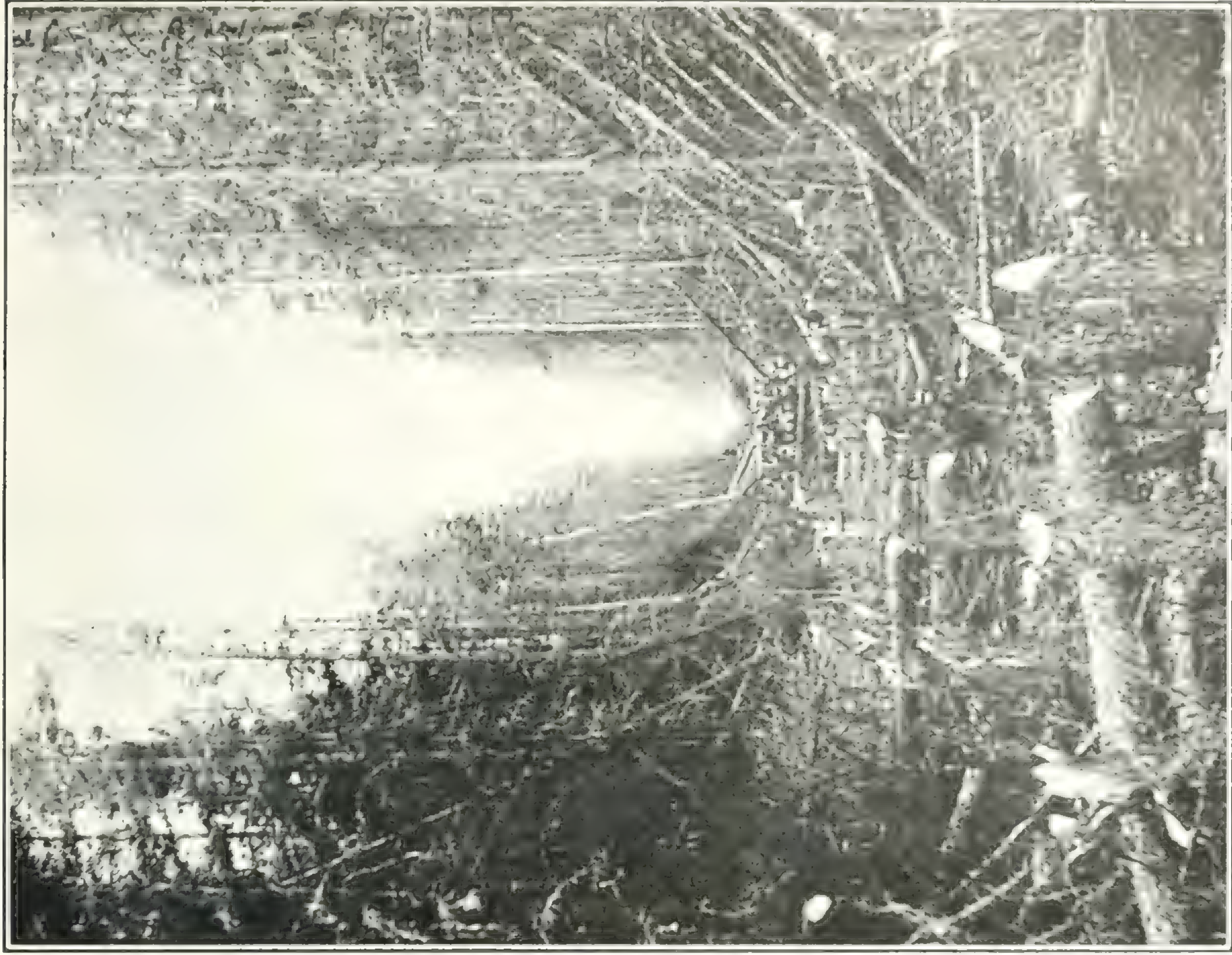


Photo by J. A. Fletcher, D. L. S.
Twenty-seventh Base Line in Range 22, West of South Meridian.

Small poplar and spruce cover a great part of the land, but many open prairie patches are found and these are good. The land would not be difficult to clear as the timber is small.

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The following is a record, obtained from the Hudson's Bay company at Fort Vermilion, of the conditions of the river at that place for the last twenty-four years:—

Year.	Ice starts moving.	First crossing in open water.	Ice starts drifting.	First crossing.	Year.
1890.....	May 4.....	May 8.....	Nov. 16.....	Nov. 30.....	1890.....
1891.....	Apr. 23.....	" 1.....	Oct. 29.....	12.....	1891.....
1892.....	May 11.....	" 15.....	Nov. 4.....	8.....	1892.....
1893.....	" 3.....	" 10.....	Oct. 31.....	4.....	1893.....
1894.....	Apr. 29.....	" 6.....	Nov. 4.....	10.....	1894.....
1895.....	" 25.....	Apr. 29.....	" 7.....	15.....	1895.....
1896.....	May 2.....	May 5.....	" 7.....	10.....	1896.....
1897.....	Apr. 20.....	Apr. 26.....	Oct. 30.....	1.....	1897.....
1898.....	" 23.....	" 27.....	" 27.....	1.....	1898.....
1899.....	May 5.....	May 10.....	" 26.....	12.....	1899.....
1900.....	Apr. 14.....	Apr. 20.....	Nov. 4.....	15.....	1900.....
1901.....	" 26.....	May 3.....	" 2.....	6.....	1901.....
1902.....	May 1.....	" 6.....	" 4.....	8.....	1902.....
1903.....	" 3.....	" 13.....	" 11.....	19.....	1903.....
1904.....	Apr. 17.....	Apr. 24.....	" 16.....	30.....	1904.....
1905.....	" 27.....	" 30.....	Oct. 23.....	1.....	1905.....
1906.....	" 20.....	" 22.....	Nov. 10.....	16.....	1906.....
1907.....	May 6.....	May 13.....	" 8.....	13.....	1907.....
1908.....	Apr. 30.....	" 6.....	Oct. 28.....	2.....	1908.....
1909.....	" 20.....	Apr. 22.....	Nov. 5.....	13.....	1909.....
1910.....	" 25.....	" 28.....	" 1.....	9.....	1910.....
1911.....	" 23.....	May 3.....	Oct. 31.....	9.....	1911.....
1912.....	" 29.....	" 1.....	Nov. 1.....	9.....	1912.....
1913.....	" 25.....	" 2.....			1913.....

I have the honour to be, sir,

Your obedient servant,

J. R. AKINS, D.L.S.

APPENDIX No. 12.

ABSTRACT OF THE REPORT OF C. F. AYLSWORTH, D.L.S.

RESURVEYS IN MANITOBA.

I organized my party and procured my outfit at Winnipeg, and on May 5 I left by the Canadian Northern railway for Eriksdale. My first work in this district was to determine the necessity for a resurvey of township 21, range 3, west of the principal meridian.

I next began the resurvey of township 22, range 4. This township is rather stony, but wood for fuel and building material is plentiful. When the stones are removed the soil will be excellent for any desired purpose. There are a number of settlers in the township but as yet the majority of them have not made much progress toward the cultivation of their land. We completed this resurvey on August 1. We then began the resurvey of township 23, range 5.

We experienced some difficulty in this survey owing to the many large and small floating muskegs in this township. The high land is rather stony, but there is an abundance of fuel and building material to be had. The hay in the numerous sloughs is of a poor quality and affords a barely sufficient supply for the present requirements. There are a number of new settlers of a good class, but they have not made much progress yet. When the stones are removed the soil will be good for mixed farming. A number of people were looking for homesteads in this township while we were there.

The northeast quarter of this township abounds with game such as moose, deer and elk, but it is doubtful if many of them will remain there after this winter's hunting.

The past season was dry, and as there are not many wells in the district it was difficult to obtain water for domestic purposes, but this disadvantage can be remedied as the water to be obtained from this soil is excellent.

On September 20 we proceeded to township 16, range 6, east of the principal meridian, to complete the resurvey of the township. We then returned to township 21, range 3, west of the principal meridian, and proceeded with the resurvey of this township.

The progress of our work was expedited by the early freeze-up, and we were able to travel on the ice as early as October 20.

The land in this township is stony, and I would estimate that about 50 per cent of it is muskeg and water. There is some good land in the northeast quarter of the township. An abundance of wood for fuel and building purposes and considerable first-class hay is to be found. The township lies about midway between the Oak Point and the Grosse Isle branches of the Canadian Northern railway, and the locomotive whistle from each branch can be heard in this township.

Old timers inform me that much of the comparatively high land is liable to be flooded by excessive rains, and that years ago a number of settlers who lived there were compelled to leave and abandon their homes. The many abandoned shacks and clearings we saw bear mute testimony to the correctness of this information. There are, however, many desirable homesteads in the northwest quarter of this township.

We completed our work in this township on December 2, after which I disbanded the party, made the necessary arrangements for wintering the outfit, and left for home, where I arrived on December 10.

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APPENDIX No. 13.

ABSTRACT OF THE REPORT OF P. R. A. BELANGER, D.L.S.

INSPECTION OF SURVEY CONTRACTS IN SASKATCHEWAN.

I began the organization of my party at Prince Albert on Monday, May 12, 1913, and after spending a week in hiring men, buying supplies and securing my transport outfit from Henribourg, I shipped the whole outfit by rail to Dumble, a siding on the Big River branch of the Canadian Northern railway.

From Dumble we drove easterly for nearly three days over a trapper's road, meandering around numerous lakes and sloughs before we reached township 55, range 5, west of the third meridian, where we pitched camp on the north bank of Sturgeon river.

Our work there consisted of the inspection of contract No. 19 of 1912. This contract comprises township 54, range 5, and townships 55 and 56, ranges 4 and 5, and covers a hilly country which is situated at the height of land between watercourses running southerly to the Saskatchewan and northerly to Montreal lake.

The land is still generally heavily timbered, but small openings are found along Lofthouse creek in township 55, range 5, while larger ones are found in township 54 of the same range along Sturgeon river, where good homesteads can be located. Scattered mixed farms could be established at intervals along the streams above mentioned or in the vicinity of a few lakes where hay is found in fairly large quantities. This country can be reached from the west by the road we followed, or from the east by the surveyors' road, branching in township 56, range 1, from the Prince Albert-Montreal lake trail.

From this contract I proceeded on June 10 westerly to contracts Nos. 31 and 32 of 1912. I followed the Green lake trail to Witchehan lake and from there to Edam, a small town on the Canadian Northern railway northwest of Battleford, where I secured supplies before continuing my journey northerly via Brightsand and Makwa lakes.

The road which I followed from Witchehan lake to Brightsand lake passes through thriving settlements where farmers were busy breaking land or seeding; but from Brightsand lake northwesterly the road enters a bush country which extends to Makwa lake and which is unoccupied, except in the northern part of township 57 and the southern part of township 58, range 21. There a few settlers are found and a few more could settle to advantage. This applies also to the lands at Makwa lake, where good mixed farming could be carried on. Hay grows in large quantities and the land is of first quality.

From Makwa lake I followed a surveyor's trail northerly to the south bank of Beaver river, and by cutting a small piece of road down the bank I reached the river flat and crossed the river in section 6 of township 61, range 22, on a strong raft which I built for that purpose. From that crossing, by cutting about three miles of road northerly I found the surveyor's road which leads through both contracts.

The inspection of these two contracts kept the party busy from July 1 to the 30th, both days inclusive. The country covered by these contracts comprises townships 62 and 63, range 21, townships 61, 62 and 63, ranges 22 and 23, and townships 63 and 64, range 24, west of the third meridian. - With the exception of a practically clear opening extending east and west in the centre of township 62, range 22, where a small colony of settlers could locate at once to advantage, the townships inspected are more or less timbered and need clearing.

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This part of the country can be reached by the road which I followed but better roads are found running due north from Fort Pitt. Upon one of these a ferry was established last summer, crossing Beaver river. It is also easily reached from Cold lake by an Indian trail running easterly to Lac des Isles and Waterhen lake. Good milling spruce is found along the road in township 62, range 23, near Lac des Isles. This lake abounds with fish.

On July 31, not knowing of any short road which would take us directly to our next work, the inspection of contract No. 28 of 1912, in townships 63 and 64, range 16, and townships 62, 63 and 64, range 17, west of the third meridian, we returned to Makwa lake, whence we followed an Indian trail branching easterly to Meadow lake. Before reaching the latter place we passed through a belt of exceedingly rich land which is occupied by only a few ranchers.

From Meadow lake we followed the Green lake trail northerly and northeasterly for about twelve miles and thence branched off to Morin's ranch in the valley of Beaver river where we crossed the river with a row-boat, and entered contract No. 28.

The country we passed over in this contract may be described as heavily timbered and unfit for immediate settlement, though the land is fair; but at "the narrows," on the north shore of Waterhen lake, as well as along Waterhen river near where it empties into the lake, are found stretches of meadow land where large quantities of hay can be obtained. A few families of Indians were the only inhabitants we met in this country; they live on game and fish which is abundant in the vicinity. They are great believers in offering guns, rifles and material of all kinds to the great Manito for the success of their hunting excursions. They appeared very anxious to know whether they would be disturbed in their wilderness by settlers who might take their land. This district is reached by the road we followed or by an Indian trail from Cold lake to the west side of Waterhen lake.

On August 19, having completed the inspection of contract No. 28 I proceeded to my next work, the inspection of contract No. 23 of 1912, comprising townships 53 to 56, range 13, and township 56, range 12, west of the third meridian. This country was reached by following a long circuitous route via the Battleford-Green lake trail from Meadow lake to Birch lake, and thence by the Chitek lake trail to township 53, range 13, where we commenced work.

Fifteen days were occupied in the full inspection of four townships out of the six comprised in this contract. The Battleford-Chitek lake trail runs across a large meadow in townships 53 and 54, range 13, where thousands of tons of first class hay can be cut, principally near the southern end of Chitek lake where a large dairy industry could be established with great advantage. This place is used by a rancher from Rabbit lake, as winter quarters for his cattle. The eastern half of township 53, as seen along the road, is very suitable for mixed farming though in need of clearing. Good soft water is found in creeks and in Chitek lake which is full of whitefish, jackfish and pickerel.

Having completed the inspection of contract No. 23 we entered contract No. 22 in range 12, on September 15, to make the inspection of the part of the contract surveyed. In passing Boutin post office, however, I received instructions to limit my operations in this contract to the inspection of the monuments marking corners in townships 55 and 56, range 11. I therefore temporarily abandoned this inspection, and proceeded to contract No. 20 of 1913, comprising townships 57 to 60 inclusive, range 15, and two-thirds of township 60, range 14.

To reach this work we followed an old branch of the Battleford-Green lake trail along the east shore of Chitek lake as far north as the north end of the lake where we branched off westerly by cutting a road which took us to section 4 of township 57, range 15, where we set up camp on the north bank of Alcott creek. This new road crosses several creeks along which are found good hay meadows which would warrant

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the establishment of a few mixed farms. The remainder of the country along this road, as well as in contract No. 20 is, with the exception of a few small openings in the valley of Alcott creek, more or less heavily timbered and broken by extensive muskegs, and consequently not fit for immediate settlement.

The only way to enter this part of the country with wagons at present is by following the road which we used, but it could also be reached from Meadow lake by an Indian pack trail along which a wagon road could easily be cut.

On October 8, having completed the inspection of contract No. 20, we returned from range 15 to range 12 to complete the subdivision of townships 54 and 55, range 12, and also to continue the inspection of contract No 22, in townships 55 and 56, range 11. This inspection and the subdivision work in the two townships above referred to kept the party busy until November 29. The whole of township 55 was completely subdivided, while in township 54 our work was limited to the survey of the north boundary of the township, together with the tier of sections adjoining it on the south side. This fractional part of township 54 as well as the two southern tiers of sections in township 55, is all rolling country, timbered with a second growth of poplar, birch and willow, partly dry and easy to clear for immediate settlement. The land is fair and well watered by marshes and several lakes, the largest being Chitek lake which encroaches on sections 5, 6, 7, 8, 17, 18 and 19 of township 55, and section 31 of township 54; this lake abounds with fish of all kinds.

The remainder of township 55, range 12, is more or less heavily timbered. The soil is light and generally unfit for immediate settlement, but the timber can be used for building purposes, railway ties, and cordwood.

With the exception of the northern tier of sections, township 54 forms part of contract No. 22 which I inspected, and may be described as open and generally suited for farming purposes in the eastern half, but the western half is more timbered and broken by muskegs, which render it unsuitable for immediate settlement. The southeast quarter of this township, as well as the northeast quarter of township 53, is occupied in summer by a rancher of the south settlements, who brings his cattle in to fatten them for the market.

On November 10, owing to the serious illness of my wife, it became necessary for me to return home. My party was left in charge of Mr. E. W. Hubbell, D.L.S., for the remainder of the season.

Before closing my report I would like to make special mention of the valley of Beaver river, which has in the past been the breeding home of the industrious animals from which it derives its name, and which by their yearly damming of the river have converted its valley into immense hay meadows where dairy farmers and ranchers can secure thousands of tons of the very best hay, principally on the west side of the mouth of Meadow creek, where a few small ranchers are already located. I cannot emphasize too strongly the great advantage offered in this river valley to settlers who do not care for grain cultivation. For those in search of mixed farming land, I would recommend the country in the vicinity of Meadow lake.

No minerals of any kind were found during the survey, but large game, such as moose and deer, is still plentiful, and partridges, ducks and rabbits are abundant. Good water is also found everywhere.

APPENDIX No. 14.

REPORT OF G. A. BENNETT, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA, SASKATCHEWAN, AND ALBERTA.

THILSONBERG, ONT., January 14, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report upon the miscellaneous surveys performed by me in the provinces of Manitoba, Saskatchewan, and Alberta, during the past season.

These surveys were very varied in character. They consisted in restoring and re-establishing obliterated and lost monuments, traversing lakes and rivers whose beds and channels have considerably altered since the original survey, surveying the beds of lakes which have dried up and yielded many acres of valuable hay and farm land, making original surveys of coal-mining leases and park boundaries, destroying duplicate and river-lot monuments, investigating various matters in connection with the survey of Dominion lands and locating and correcting where possible, errors in original surveys, under the provisions of section 57 of the Dominion Lands Surveys Act. When it was found impossible to alter the original surveys, retracement surveys were made to obtain a true record of the metes and bounds of the lands as defined by the misplaced monuments of the original survey, so that the areas could be shown correctly upon the official plans.

The field operations were begun by a resurvey of part of township 18, range 18, west of the third meridian, to correct a small error in the original survey. Township 15, range 2, west of the third meridian, was next visited to investigate reported errors in the original survey. Large errors were found affecting much of the township, so upon petition of the settlers and with the consent of all the owners affected, a correction survey was made. Valuable improvements were thereby effected, as the boundaries of several improved quarter sections were moved over forty rods. To make a peaceful adjustment of the various claims, the settlers held a meeting one evening and upon their request, I attended. There I explained the provisions of the law, as contained in the Dominion Lands Surveys Act, and gave authoritative statements of the various improvements changing ownership from the correction of the survey, thus preventing exorbitant demands. After considerable discussion, a friendly settlement of their claims was effected. Agreements, in writing, were then drawn up stating definitely the payment to be made in each case, and these were signed by the parties interested.

Small retracement surveys were next made, in township 19 A, range 1, west of the second meridian, to destroy a false duplicate monument; in township 18, range 20, west of the principal meridian, to investigate the position of a section corner as defined by a witness monument of a recent survey, and to correct the error found; and in township 20, range 22, west of the principal meridian, to investigate and verify the position of a section corner as defined by a witness monument of a recent survey. These townships are wooded and are settled by Ruthenians and Galicians. Rapid progress has been made by these industrious settlers in clearing their farms and to-day they are building modern dwelling houses with large barns, and they possess fine horses and many cattle.

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On June 25, a resurvey was begun in township 16, range 2, west of the third meridian, upon a petition of the settlers there. A complete correction of the known errors in the survey of this township was made, and payment for transferred improvements was agreed upon by the owners interested.

An investigation of reported errors in township 7, range 10, west of the second meridian was then made. In this township very large discrepancies were found in the original survey. Most of the township was retraced and the largest errors corrected, consequently some improvements of small value changed ownership. The original survey was so erroneous (some of the monuments being one-quarter of a mile from where they should have been) that the settlers had disregarded the old survey monuments and divided the land as equally as they could among themselves.

As much of the land in this township is held by absentee speculators, the settlers are few and scattered. Little progress has been made in road building or the drainage of numerous sloughs, so that it was difficult to drive across the township last year after the June rains. The municipal authorities informed me that they had hesitated to build roads on account of the crookedness of the section lines arising from errors in the original survey, but that the accumulated appropriations for this work would be spent immediately upon the resurveyed road allowances. This district is noted for its rich clay loam soil, and the fact that fine crops have been obtained over a term of years is attested to by the fine buildings and stock of the prosperous farmers.

According to the Dominion Lands Surveys Act the consent of all owners of lands affected must be obtained before a resurvey may be made to correct the original survey. Generally all resident owners are anxious to have an erroneous survey corrected, but the indifference and suspicion of absentee owners render it difficult to carry out the wishes of the settlers. When the errors in the survey are discovered before improvements have been made or lands patented, the corrections are usually readily accomplished.

On July 23, I retraced the north boundary of Katepwe park in township 20, range 12, west of the second meridian and restored the boundary monuments. Mr. Norman Ross, chief of the Tree Planting Division, Indian Head, who has charge of the park, requested me to also survey the east boundary. However, as this necessitated the measurement of several lines across Katepwe lake, which was impracticable at this season, the survey was not completed until December, when the lake had frozen. On the surveyed boundaries of the park, fences have now been erected to preserve to the people of eastern Saskatchewan, the beautiful shady groves along the lake, which render this place so attractive. Several hundred people were enjoying themselves there during July and the park is certain to become more popular when people learn of its existence.

I proceeded to Alberta on July 29 and began the retracement of both sides of the fifth correction line through ranges 9, 10 and part of 11, west of the fourth meridian, to ascertain the extent of the errors in the outline surveys. This district has been recently homesteaded and the dry weather in June rendered the settlers' crops on new breaking poor. However, the farmers, who had started into mixed farming were not complaining and their stock looked well.

The survey of the boundary of the Rocky Mountain Forest reserve through townships 1, ranges 28 and 29, west of the fourth meridian, was next completed. It appears that most of this rough country had once been covered with forest, but bush fires have denuded many of the mountain slopes. Much fine grazing land has resulted and cattle by the hundred and sheep by the thousand were noticed feeding upon the rich pasturage near and in the forest reservation. The cattle were doing little injury to the forest growth, but the sheep were destroying most of the vegetation and so largely preventing reforestation.

The traverse of the banks, by-channels and islands of Bow river through sections 13 and 14, township 24, range 1, west of the fifth meridian, was completed by

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September 6. The topography was found to have very materially changed during the interval of thirty years, since the original survey.

From here, I proceeded to township 1, range 12, west of the fourth meridian, and completed the retracement of part of the township. Then a survey was made of that part of township 17, range 5, omitted by the original survey. South Saskatchewan river was also traversed throughout the township and twenty-three river-lot monuments destroyed. These old river lot mounds have proved confusing to the settlers and in consequence one homesteader had built his house off his homestead.

A considerable portion of this district appears to be more adapted for ranching than grain growing. Wheat farming has not proved, as yet, very successful, but the settlers engaged in mixed farming are prosperous. Many ranchers are irrigating land to grow alfalfa. A beautiful meadow of 100 acres was noticed in township 1, range 12, on the Milk river flat, the water used being obtained by damming Red Deer creek. This small scheme has proved a success. Along the South Saskatchewan several other schemes were noticed. Here the water is obtained by pumping it from the river to the top of the river flats. Gasoline engines are used to run the pumps, and the high cost of the power so obtained renders the practical success of these schemes somewhat doubtful. However, a rancher, Mr. Lokier, showed me where gas was bubbling up through the water of the South Saskatchewan in township 17, range 4. This proved on test to be largely methane gas, therefore it is probable that the settlers may obtain natural gas here at a moderate depth and then have a cheap fuel for power. Many seams of coal were noticed in the river banks in township 17, range 5. This coal is used for fuel by the neighbouring settlers. The veins are numerous, and some lignite veins are five feet thick, but the coal of best quality occurs in veins about two feet thick. On account of the distance from railways and the lack of local demand, no commercial mining has been done.

On September 25, I began the survey of coal leases in township 19, range 4, west of the fifth meridian. An investigation into the location of some old coal claims surveyed twenty years ago showed that these claims were placed approximately one mile in error upon the map of the old survey. Because of this mistake in the former survey, these claims occupy part of the land that was supposed to be open for leasing.

The work in Alberta was completed by three more small surveys, the traverse of St. Mary river through township 2, range 25, a resurvey to correct one section line in township 2, range 19, and an investigation and necessary surveys of a dry lake shown by the original survey as Horsetly lake in township 9, range 16, all west of the fourth meridian.

On October 18, I began the investigation of Whitebear lake in townships 23, ranges 15 and 16, west of the third meridian. The lake was found to have completely dried up, and the dry bed was surveyed so that the land might be disposed of. Similar surveys were made to deal with Pelican lake, in townships 18 and 19, range 1, which has become dry. These dry lake bottoms are of little value until improved. The old beaches are very stony and the bottoms are grown up with foxtail or wild barley, which is practically useless for hay or pasture.

The following surveys completed the operations in Saskatchewan: A small resurvey upon petition to correct errors in the original survey of township 18, range 8, the survey of Swan lake and retracement of a large part of township 10, range 8, on account of large errors found in the original survey, the investigation of a reported error in the returns of the survey of townships 3 and 4, range 18, the completion of surveys in connection with Katepwe park townships, 19 and 20, range 12, and a small resurvey in township 11, range 6, all west of the second meridian; the traverse of one bank of the South Saskatchewan through townships 25, ranges 5 and 6, a restoration survey upon petition of owners of lands affected in township 25, range 5, and the retracement survey of a small portion of township 23, range 9, all west of the third meridian.

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On December 16, operations were begun in Manitoba by an investigation of the survey of township 25, range 9, west of the principal meridian. It was found that considerable worthless swamp land had not been correctly surveyed by the original survey. This district is so wet that it is very difficult to make surveys until late fall or winter. The settlers here are generally from Iceland and appear to be fairly prosperous. They cut hay around the marshes for their stock and grow but little grain. The winter fishing on lake Manitoba is another important source of income to the people of this district.

The following surveys were made to correct errors found by the inspectors in surveys recently made under contract; the resurvey of one section line in township 21, range 11, west of the principal meridian, the survey of a small lake omitted in the original survey of township 10, range 15, and the re-marking of posts and placing of mounds in townships 10, ranges 13 and 16, east of the principal meridian. Investigation showed that the posts reported wrong were correctly marked in townships 11, ranges 13 and 14.

In addition to the miscellaneous surveys, observations were taken whenever opportunity permitted, for magnetic declination, inclination and total force, these observations not materially retarding the regular work. Sixty-three observations for declination were obtained in forty-one different townships with a Bausch and Lomb trough compass attached to the standards of a Watts transit.

The observations for magnetic inclination or dip and total force were made with a Dover dip circle according to Dr. Lloyd's method. Twenty-six stations were occupied, a total of seventy-nine observations for inclination and forty-nine observations for total force being obtained.

Before and after the field operations, the correction to be applied to the readings of magnetic declination of my compass and the "A factor" of the total force readings were obtained personally at the Magnetic Observatory, Agincourt, Ont. As my assistant took many of the observations for dip and total force, he also determined the constants of the dip circle at Agincourt in order to correct for personal equation.

I have the honour to be, Sir,

Your obedient servant,

G. A. BENNETT, D.L.S.

APPENDIX No. 15.

ABSTRACT OF THE REPORT OF G. H. BLANCHET, D.L.S.

SURVEY OF THE 22ND BASE LINE WEST OF THE FOURTH MERIDIAN.

The organization of the party having been completed we left Edmonton on February 12, 1913, for Prince Albert and from there we proceeded via the Canadian Northern railway to Big River settlement.

From Big River to Isle à la Crosse, a distance of 165 miles, the Isle à la Crosse Fish Co. have opened up a good winter trail by which fish are brought out from the northern lakes and merchandise is taken in, to be distributed in summer by water.

Beyond Isle à la Crosse there was no trail and it was reported that hay was scarce and the ice bad. The winter had been very severe in this country, the snow being over two feet deep and a cold north wind blowing almost continually. Under these conditions it was difficult to hire freighters, but finally seven teams were obtained which with my own three were able to handle the outfit. Owing to the difficulty we had breaking trail with the heavy freighting teams, I decided it would be impossible to use bob-sleighs on the line with my light horses, so I disposed of my sleighs and replaced them by flat sleighs.

On March 11, the post at Methye lake was reached and the freighters were sent back. A day was spent outfitting toboggans and pressing hay, and then we proceeded by the dog trail to our starting point at Garson lake, reaching there on the 14th. After establishing the meridian across the lake, the base line was begun on the 15th.

The height of land between the Churchill (Hudson Bay drainage) and the Athabaska occurs about the centre of range 2, being marked by extensive muskegs rather than an elevation. The region included in this watershed has little economic value, the timber being small and the land too wet for agriculture, but it is useful in conserving the water supply.

The muskeg country extends westward to Christina river which crosses the line near the centre of range 4. This river flows in a northeasterly direction, discharging about 1,500 cubic feet per second, and it is broken by many rapids from here to its juncture with Clearwater river. It drains the country lying between the height of land and the "Little Rocky mountains," its basin extending south to township 74. Its immediate valley first becomes appreciable about three miles south of the line and from there it increases rapidly to about six hundred feet in depth at its juncture with the Clearwater. Along the river flats there are some small groves of excellent spruce and upstream there are some good hay sloughs. There are also many areas of good agricultural land along this river and its tributaries.

Farther west the country rises towards the "Little Rocky mountains" from which many fairly large streams flow northeasterly into the Christina. In general the soil on the ridges is rather light, and in the valleys where not too wet it is good. Much of this district has been fire-swept but some areas of good timber remain, notably along Grégoire river.

The "Little Rocky mountains" are roughly triangular in shape, the vertex being about nine miles north of the base line at the west side of range 8, whence lines extending southeast and southwest mark the limits of the elevated area. Proceeding southward they become broader and flatter, the south boundary being a curve with Christina river occupying the valley to the south. The northerly border of the "mountains" is marked by escarpments with rock exposures where they are cut by creek valleys. Extensive lake-like muskegs which give rise to many streams occupy most of the top of the plateau. These streams cut deep valleys through the borders of the plateau which is, consequently, very rough. The drainage is northeasterly into the Christina and thence via the Clearwater into the Athabaska, and north and north-westerly through Hangingstone and Horse rivers into the Athabaska.

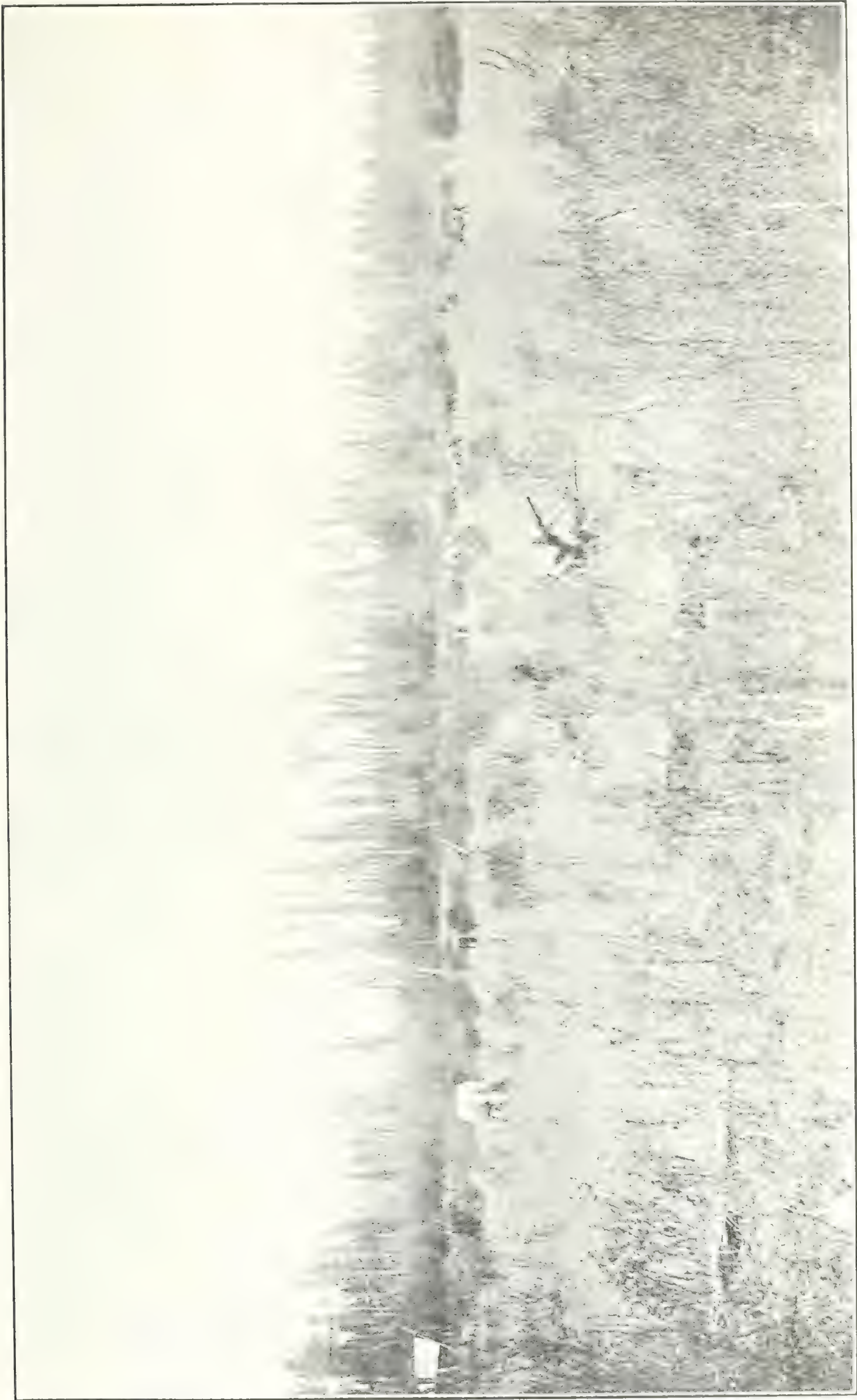


Photo by G. H. B. 1915, D. L. S.

Beaver Meadow on Twenty-second Base Line West of Fourth Meridian.

These beaver meadows are formed by deposits of silt carried down by the river and stopped by the heavier dams. Extensive flats of very rich land were thus formed and, as there are no trees, the snow melts very early in spring. Horse feed can thus be obtained on these flats long before the snow disappears in the woods where the evergreens prevent the heat of the sun from reaching the snow.

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In range 10 the line left the high lands of the mountains, dropping to a country which continues almost level to the Athabaska. The drainage here is poor and, consequently, the land is principally muskeg. The only horse feed obtainable was in the beaver meadows along the small streams. The country south of the base line continues the same till the slope of the mountains is reached. Two principal branches of Horse river rise in the mountains to the south and cross the line, one in range 12 and the other in range 14, and after flowing north for a few miles they both turn easterly, flowing in parallel courses and finally uniting in range 10. From there the stream swings off to the north, emptying into the Athabaska. There is considerable good land lying along its course.

After crossing the westerly branch of Horse river the line enters what is known locally as "Twasinaw" muskeg, which is a peculiar lake-like area about ten miles across and almost surrounded by poplar and jackpine ridges. Algar lake is situated near the centre of this muskeg, and lies just south of the line. Two branches of Algar river rise here and, after crossing the line in range 15, unite about two miles north and flow in a northerly direction into the Athabaska, which at this place is about fifteen miles north of the line and flows in an easterly direction. The sleigh road from Horse river to McMurray passes through this muskeg and crossing the line at the westerly side of range 14 practically follows Horse river down to McMurray.

Athabaska river crosses the line about the centre of range 17, and is approached through an extremely wet stretch of muskeg broken by islands and ridges of jackpine. The line passes just north of "Grand" rapids and across "Little Grand" rapids which extend down stream for about two miles. These rapids form the chief obstacle to navigation on this section of the river which here, becoming wide and shallow, flows through a bed of sandstone. An island about a quarter of a mile long divides the river where the greatest fall occurs into two unequal channels. The westerly, though the wider and fairly straight, is unnavigable, being shallow and strewn with large boulders, while the east channel through which the scows are taken is narrow and crooked. "Little Grand" rapids, though rough, are not very dangerous. As far as power development is concerned the situation is somewhat similar to the Lachine rapids on the St. Lawrence and might, perhaps, be similarly treated. "Grand Rapids" settlement, situated on the east bank of the river here, was crossed by the line. The river valley is about 400 feet deep.

Westward from the river the country has been badly burnt, though some areas of timber, protected by muskeg, remain. The country bordering the river is much cut up by deep creek valleys but contains some good agricultural land.

After the abrupt rise out of the Athabaska valley the country ascends gradually to the west for about fifteen miles, and is drained by many small streams rising in the muskegs several miles back from the river. These have deep abrupt valleys where they enter the Athabaska valley, and in consequence the country bordering the river is very rough in places. There are also several fairly large rivers with more extensive drainages, the chief of which are the Loon, Three rivers and the Little Buffalo. Loon river rises about ten miles west of the Athabaska and flows northeasterly into it at the head of the Grand rapids. Most of its valley has been fire-swept but a few bodies of good timber remain. The stream is about twenty-five feet wide at its mouth. About six miles north of the line three fair-sized streams flow northeasterly into the Athabaska, all entering it near the same point. They all rise in lake-like areas of muskeg in the interior. Little Buffalo river rises in a lake of the same name in the northerly part of township 86, range 20, and flows easterly into the Athabaska near where it makes its big bend from a northerly course to an easterly one. In several places at the mouth of this river natural gas escapes through cracks in the earth in sufficient quantities to keep up a brisk flame. With the exception of the strips of dry land bordering the river and its tributary streams as far back as they hold their valleys, the country is principally muskeg.

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The rainfall in July was excessive and this, combined with the swampy surface, practically flooded the country, especially the hay meadows, and these conditions finally made it advisable to postpone the completion of the line till after freeze-up. The party was therefore taken out to Edmonton and discharged.

The autumn of 1913 was remarkably fine and mild. The ice on the lakes and rivers did not become safe till December, and the snow was very scanty till the end of that month. After organizing a new party I left Edmonton on December 2 and proceeded to the work by way of Athabaska and Wabiskaw, reaching the latter place on December 8. There was practically no snow there, and Wabiskaw river was reported to be open. It was therefore necessary to open up a sleigh road from the north end of Wabiskaw lake to the line, a distance of about sixty miles by the route we travelled. The line was reached on December 18 and the next day we started working on the line and bringing up the caches. During the interval while we were out, one of the caches was broken into and the contents stolen; this left us very short of supplies for a time.

The height of land between the Athabaska and Wabiskaw rivers was crossed in range 20. This is covered by an extensive tamarack muskeg which drains easterly through the Three rivers and Loon river into the Athabaska and westerly via the Wood Buffalo into Wabiskaw river. The country in the neighbourhood of the "height of land" is practically level and consequently all muskeg. Some interesting features may be observed there. The dry land, lakes and rivers, found ordinarily, are here represented, respectively, by spruce muskeg, lake-like areas of tamarack muskeg and tamarack runs. With an outlet that would give efficient drainage the country would soon rid itself of its excessive moisture, but the problem of draining an extensive level district is a difficult one. In considering the problem of reclaiming the muskegs of the north country the question of muskeg subsoils is an important one, and investigation reveals some interesting conditions. From the amount of sand forming the surface in many parts of the north and from the fact that precipitation is not ordinarily excessive one would expect natural absorption to go on to a much greater degree. This is prevented to a greater extent by an impervious stratum of clay with a thickness varying from a few inches to several feet lying on top of the sand. It is probable that the clay is of recent origin as it lies generally in the depressions, the underlying sand coming to the surface in the ridges. This sand may not have a great depth as is suggested by the fact that it sometimes is of a quicksand nature. The ice which remains most of the year under the moss in muskegs lies on top of the clay. The most important considerations in facilitating drainage are, first the removal of the surface moss to cause the ice to melt more quickly and allow freer flow, and secondly to increase absorption, if possible, by ditches cut through the impervious clay. The usual profile of the northern swamp lands is more that of a shallow plate than of a bowl such as is usually found in Northern Ontario. Wabiskaw river crosses the line in range 23. It has no immediate valley but occupies the bottom of a wide shallow valley which is about fifteen to twenty miles wide. Much of this valley is muskeg but areas of good land occur along Wood Buffalo river flowing northwesterly into the Wabiskaw north of the line and Trout and Bear rivers flowing easterly, south of the line. These three rivers, which are each from a chain to a chain and a half wide, form, with the addition of the Wabiskaw lake drainage, the principal sources of the upper Wabiskaw. There are some stretches of merchantable timber along each. There is also an area in townships 82, ranges 23 and 24, known locally as "the mountain" consisting of ridges and islands on which there is a good growth of poplar and spruce and which contain considerable land of agricultural value.

There are many small rapids along the Wabiskaw but probably none producing water-powers of economic value.

The fifth meridian was reached on January 26, 1914, and on the 28th, the work of closing having been completed, the party left for Edmonton, arriving there on February 7.

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APPENDIX No. 16.

REPORT OF W. J. BOULTON, D.L.S.

SUBDIVISION SURVEYS IN SOUTHERN ALBERTA.

CALGARY, ALBERTA, March 2, 1914.

E. DEVILLE, Esq., LL.D.

Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on my operations in the field during the past season.

Having completed the organization of my party I left High River, Alberta, on May 17, 1913, and two days later arrived at my first work, in township 16, range 3, west of the fifth meridian.

The work in this township lay in the westerly and southerly parts, which are mostly covered with willow brush and poplar. The township is well supplied with splendid water, being traversed in its northerly sections by Pekisko creek, a stream about fifty links in width, and by many other smaller creeks which are well distributed throughout the township.

After completing this work, I did some subdivision in townships 15, ranges 2 and 3, and township 14, range 3, in the order named. Two small lakes were traversed in township 15, range 2.

Townships 16, 15 and 14, range 3, are quite similar in their general characteristics, varying from rolling and hilly to rough and mountainous, the ravines and coulees being mostly covered with willow, poplar, jackpine and a few spruce.

From a rough estimate I should say that only twenty-five per cent of the territory included in these townships can be classified as open, but that part affords an abundance of rich grass. This feature together with the provisions made by nature for water and shelter, makes the country one that is especially adapted for the grazing industry. This industry has been taken up by a few ranchers in this vicinity, and their efforts have been very successful. The soil is generally very good, ranging from sandy to black loam, but on account of the short growing season and the ever present frosts, it is not suitable for agricultural pursuits. Plenty of fish, partridges and prairie-chickens are found in these parts. Access to these townships is rendered very easy by excellent trails leading from both High River and Nanton.

On September 4, I started south to do some subdivision work in townships 8, ranges 2, 3, 4 and 5, as I wished to finish the mountainous work before October 15, which date, generally marks the advent of the stormy season in the foot-hills of southern Alberta. In going to this work, we followed a well-beaten wagon trail practically straight south, in range 2, until we arrived in township 10, where we crossed the north fork of Oldman river, turned west for about four miles and thence south on a splendid trail to township 8, range 2, where we stopped and completed the subdivision in this township. This being done, we continued on this trail which joined the Crowsnest trail, about one and one-half miles east of Burmis, a small town on the Crowsnest division of the Canadian Pacific railway. This latter trail is macadamized right through the Crowsnest pass, and is used by automobiles.

The work in township 8, range 5, was first completed, after which that in township 8, range 4, was begun. This latter work practically followed the top of Bluff

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mountain, and although it was very rough, and at times very treacherous, some excellent closings were effected, having of course to resort to triangulation in many instances. Bluff mountain is practically covered with spruce varying from six inches to two feet in diameter, but on account of the precipitous nature of the country lumbering there would be quite difficult.

Having completed this work, we moved to a small abandoned village called "Lille" from which point we did the work in township 8, range 3. The main part of this work consisted in running north on the meridian, which forms the eastern boundary of sections 5, 8, 17, 20, etc. To run the actual meridian itself was impracticable. So after running one mile north I started triangulating and traversing. I succeeded in again getting back on the line about one and one-half miles south of the northeast corner of section 32 and from there I ran due north to the northeast corner of section 29, where I deviated my bearing to hit the post at the northeast corner of section 32, finally effecting a closing of two inches in departure at this point. This township is practically all limestone ridges, with deep valleys and ravines. The valleys contain burnt timber only, which is at present used for mine props. Coal mining was an important industry at one time in this township, but has of late years been abandoned.

There are many good indications of coal in townships 8, ranges 4 and 5, and many small seams were noticed, but it has all been taken up and will eventually be worked by the companies operating in these parts.

On October 25, we left Lille for township 4, range 1, west of the fifth meridian. We left the Crowsnest road at Burmis and travelled in a southeasterly direction along a splendid wagon road, to Mountain Mill, thence south to section 7, township 5, range 1. From this point several trails provide a means of access to township 4, range 1. The country through which we passed on our way is well settled and is practically all under cultivation, and judging from improvements and the general prosperous appearance of the farms, the yield is very good.

I encountered four settlers in township 4, range 1, and ascertained from them that hay is the only thing that can be grown successfully there, the short season and intense early frost preventing any extensive agricultural operations. Ranching is engaged in to a slight extent. The westerly and southerly parts are practically all limestone ridges, with intervening valleys of green and dry spruce timber, varying from four to twelve inches in diameter, while the remaining part is rolling to hilly, mostly covered with willow brush and poplar, thus rendering the grazing possibilities only fair.

After completing the subdivision in this township, which consisted of that part lying immediately outside the forest reserve, we went to township 3, range 30, west of the fourth meridian, and completed similar surveys there. The general characteristics of this township are similar to those of the one previously mentioned. Streams of considerable size, varying from thirty to forty links in width, would provide an adequate supply of water for ranching purposes. Township 3, range 30, is very well occupied by settlers, but there are practically no improvements.

Game such as partridges, prairie-chickens, bears, mountain goats, and mountain sheep is more plentiful in this district than in any other through which I passed during the season.

The work in township 3, range 30, west of the fourth meridian, having been completed, I started north again to township 10, range 3, west of the fifth meridian. This township, which is located near the "gap" in the Livingstone range of mountains, was reached by following an excellent wagon trail to Pincher creek, thence to Cowley, and from there to our destination where we arrived on November 22.

My work in this township consisted in running south from the correction line for five miles along the boundary of the Dominion Forest reserve, and connecting up the corners on the chords to the east, all of which I completed by December 1. The meridian followed a very deep valley, which was covered by spruce, jackpine, willow

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brush and poplar. There are a few settlers in this township, but they have made no noticeable advancement or improvements. It is an exceedingly rough country, and there are several good indications of steam coal in the northerly part.

Deer are quite numerous in this locality, many hunters being attracted there during the open season.

The months of October and November were very stormy, and we were frequently compelled to cease work on account of the high winds, which I understand are quite prevalent in the foot-hills at this time of year.

I next completed the survey of the boundary of the Dominion Forest reserve, in township 11, range 2, and also that part in the southwest corner of township 12, range 1.

Having completed this work, I again returned to the locality in which I had been working during the summer months and finished the survey of the boundary of the forest reserve in townships 13 and 14, range 3, after which I moved to township 14, range 2, and completed the subdivision of that township.

During the season we succeeded in running 211 miles of line, including traverse and trial lines.

On January 12, 1914, I again arrived at High River, where I stored my outfit and made suitable arrangements for the wintering of my horses. This having been done, I, with one assistant, went to Coleman, Alberta, and completed a small survey there, returning to High River on January 17.

I have the honour to be, Sir,

Your obedient servant,

W. J. BOULTON, D.L.S.

APPENDIX No. 17.

ABSTRACT OF THE REPORT OF E. P. BOWMAN, D.L.S.

STADIA SURVEYS IN WESTERN SASKATCHEWAN.

The work on which I was engaged during the season of 1913 was an examination of the lakes and other bodies of water in the district lying south of Battleford.

I arrived in Battleford on May 17, and spent several days there in organizing my party and purchasing horses, wagons and the outfit required for the work. The party left Battleford on May 23, reaching our first work in township 40, range 19, west of the third meridian, on the 24th.

The lakes and other bodies of water in sixty-two townships were examined during the season; those which were considered permanent were traversed, and others were investigated as to their depth, locality, nature of the water, and any other points worthy of note. Camps were located at suitable points for reaching the work, usually one camp being located in each township, unless time could be saved by doing two or more townships from one camp.

Magnetic observations were taken whenever possible without hindering the regular work to any extent. Astronomical observations were also taken as often as possible when the weather was favourable. In all sixty-one magnetic and forty-two astronomical observations were obtained during the season.

In accordance with instructions the condition of the monuments in each of the townships was noted, and as much territory covered in each as was possible without loss of time on the regular work, thus serving the double purpose of seeing as many monuments as we could, and of locating bodies of water not shown on the township plans.

I closed my operations in the field on December 10 and returned to Battleford, where I discharged my men and made arrangements for wintering the horses and storing the outfit.

Most of the bodies of water examined in the prairie country have no springs or other permanent sources of supply. The quantity of water in them is variable, depending on the annual rainfall and snowfall. Many are shallow, and contain water in the spring but dry up during the summer, excepting in wet seasons. In some districts particularly in fairly level, open country, the lakes seem to have permanently dried up. In one district four such townships were observed in each of which at least one lake and several marshes existed at the time of the original survey about ten years ago, but at the time of our survey not a drop of water was found in any of them, the land being suitable for agriculture. One of these lakes which covered an area of two thousand acres or more at the time of the original survey, was found entirely dry, and part of it was producing grain crops. In other districts, where the land is more rolling, the change is not so marked, but many of the lakes now produce slough and marsh grass and large portions of the old beds have become suitable for hay or pasture land. An occasional deep lake was found, however, which will be permanent for a number of years, and in some districts springs exist which feed the lakes and tend to keep them at a more constant level. A number of alkaline lakes were also found. Very little change occurred in the limits of vegetation around such lakes even where practically dry owing to the alkaline soil. These alkaline flats require to be dry for several years before vegetation begins and then the first growth is usually foxtail and other weeds.

The settlers claim there is more water in the lakes this year and last year than there has been for the preceding three or four years. This is probably due to the wet season

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of 1912, which filled the lakes and sloughs to a greater depth than usual, and saturated the soil to a higher level so that percolation does not proceed as rapidly as it did during the preceding dry years.

The condition of settlement varies in different parts of the country. In general, however, practically all of the Government lands are taken up by settlers, except in those sections where the land is unsuitable for farming, owing to its stony or hilly nature. In some districts, the country is very well settled, almost all of the land being under cultivation, while in other parts farther removed from the railways the settlement is in its initial stages. In the better settled townships good roads are being constructed along the road allowances, and the settlers have good buildings and prosperous looking farms.

The difficulty of obtaining water in some districts is a serious drawback to the settlers. Many of them have to haul water for their stock and general use for several miles. In one instance a settler was hauling it from a spring seven miles from his home. The cost of drilling wells is usually too great for the early settler as in many cases it is necessary to drill from two hundred to three hundred feet to obtain water.

The farmers in this district are engaged chiefly in grain growing although many of them have recently been devoting more attention to stock raising and mixed farming. This seems to be advisable owing to the uncertainty of the crops on account of frosts or hail and also because of the gradual exhaustion of the soil caused by continuous grain production. Mixed farming is carried on in those districts more remote from the railways where the cost of hauling grain to the elevators becomes a serious item of expense and in hilly and wet districts where the land is hard to till.

APPENDIX No. 18.

REPORT OF M. P. BRIDGLAND, D.L.S.

TOPOGRAPHICAL SURVEY OF THE CROWSNEST FOREST RESERVE.

CALGARY, ALBERTA, February 23, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report on the operations of my party during the season of 1913, while engaged on the topographical survey of the northern part of the Crowsnest Forest reserve.

On June 2, the party started for Claresholm, from which point it had been decided to enter the northern part of the reserve. From there camp equipment and supplies were freighted in to a point near "The Gap", which is a narrow pass about forty miles southwesterly from Claresholm, where Oldman river flows through the Livingstone range. While this was being done, the horses were driven down from Okotoks to "The Gap."

Later it was learned that a better way of reaching "The Gap" was by way of a wagon road from Lundbreck or Cowley, on the Crowsnest branch of the Canadian Pacific railway. This route is shorter and is not nearly so hilly as the other.

Owing to the necessity of testing camera levels, and of determining the focal length of cameras and the speed of the photographic plates, some delay followed our arrival at the Gap. Consequently it was not until June 13 that actual survey work was started. During this time, however, the bulk of the camp equipment and supplies was moved by pack train farther into the mountains, so that no more delay would be caused by difficulties of transportation. A temporary cache was made at the ranch of Mr. R. Macdonald, about a mile west of the Gap.

From June 15 to August 6 work was carried on from this point. Trips were made up Oldman river, Dutch creek, and Livingstone river and its tributaries. It was then decided to move south towards the railway, surveying the other valleys on the way. The valleys of Racehorse, Vicary, and Daisy creeks were covered, thus completing the drainage basin of Oldman river. While the railway and the adjacent land is not included in the reserve, the boundaries are so irregular that it was decided to partially cover all the country rather than to adhere strictly to the reserve. Another reason for this decision was that as the elevations of all stations were to be based on a traverse of the railway, it was necessary to occupy stations adjacent to it in order to carry the elevations to the more distant peaks. Seven stations south of the railway were occupied in order that they might be connected with the traverse and used as a basis for elevations of future stations in the southern part of the reserve.

While no organized system of triangulation was carried out, angles were read to connect different stations as well as possible. Advantage was taken of any old signals that could be located. Stations adjacent to the railway were fixed by a traverse of the railway, and a sufficient number of the more remote stations were connected with the posts of the Dominion lands system to control the survey.

The season of 1913 was, on the whole, favourable for the work. The party left Calgary on June 2 and returned on September 25. During this time 114 triangulation stations (exclusive of section corners or secondary camera stations) were occupied and twenty-two miles of railway traversed. Only eighteen days were completely lost owing to bad weather, though work was frequently interrupted on other occasions. No delay was caused by smoke and no prolonged delay by bad weather. On account of the low elevation, the hills were seldom covered with clouds, although the higher peaks to the west were often clouded. Work on the summits was frequently interrupted by local

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thunderstorms, but these rarely lasted more than a couple of hours. The worst difficulty was due to incessant high winds, which rendered good work extremely difficult. In the absence of sharply defined topographical features, on sunny days the distance was often rendered indistinct by haze, particularly in the direction of the sun.

The northern part of the Crowsnest forest reserve covers an area of about 650 to 700 square miles and lies chiefly in townships 9 to 14 inclusive, ranges 3, 4, and 5, west of the fifth meridian. Nearly all of this area is drained by Oldman river. The chief tributaries of this river, which are Livingstone river, Racehorse and Dutch creeks, join the main stream before it flows through the Gap. This part of the reserve consists principally of rolling hills, the higher summits rising slightly above timber line. On the west side, running in a northerly and southerly direction, there is a limestone range forming the summit of the Rocky mountains and the boundary between British Columbia and Alberta. The peaks of this range vary from 8,500 to 10,000 feet in elevation. Adjacent to this range there is a series of lower hills where the highest summits run from 7,000 to 8,000 feet above sea-level. About fifteen miles east of the main range and running almost parallel to it, lies the Livingstone range, also a limestone formation. This range is slightly higher than the intervening hills, especially south of the Gap. Farther east the hills rapidly become lower.

The country as a whole is comparatively open. There are good trails which are practically free from steep grades, bad swamps, or muskegs, in all the main valleys. In many cases horses can easily be taken through country where no trail exists. In most sections feed is very plentiful, the valleys as a rule being "U" shaped, with large meadows in the bottoms. In addition many of the hillsides are open and are covered with a luxuriant growth of grass and pea-vine. During the past summer the upper part of Livingstone valley was used as a range for several hundred cattle. Wild flowers of many varieties are abundant, particularly on some of the upper slopes near the timberline. Edible fruits are scarce, soapberries (if these can be called edible) and wild black currants being the only varieties seen in any quantity.

Timber of commercial value is not plentiful. A bad fire a few years ago burned over much of the country and did a great deal of damage to the standing timber. There is some spruce near the heads of Oldman and Livingstone rivers, but the greater portion of these basins has been burned over and is either bare or is covered with a growth of small jackpine. In the southwest part of the reserve near the heads of Dutch, Racehorse and Vicary creeks, and along the valley of Allison creek, there is a considerable quantity of spruce about eighteen inches in diameter. East of Livingstone range the country is more open and there is no timber of commercial value. The varieties of trees usually seen are spruce, small poplar and jackpine in the valleys, scattered fir, spruce and jackpine on the hillsides, and spruce, balsam and pine on the upper slopes.

So far as could be learned no minerals other than coal have been discovered. Much of the country is held under lease for coal rights, and stakes were frequently seen. In only one place, however, were surface outcrops seen by any member of the party.

Trout abound in Oldman river and its tributaries, but are not as plentiful as in former years. During the fishing season of 1913 the Gap and its vicinity was visited by many fishing parties, and there is no doubt that as the attractions of this locality become better known the number of parties will increase and the number of trout will correspondingly decrease. At the present time there are very few fish in Crowsnest river or its tributaries at the southern end of the reserve. Large game does not seem to be very plentiful. Deer were seen on several occasions, and some mountain goats were encountered on the main range. There are a few bears, but berries and wild fruit are too scarce to offer them much inducement to remain in the country permanently.

I have the honour to be, Sir,

Your obedient servant,

M. P. BRIDGLAND, D.L.S.

APPENDIX No. 19.

REPORT OF J. A. CALDER, D.L.S.

SUBDIVISION SURVEYS AROUND KAMLOOPS.

ASHCROFT, B.C., January 15, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa.

SIR,—I have the honour to submit the following general report on my surveys in the railway belt, British Columbia during the season of 1913.

I left Kamloops, where my party was organized, on May 9, 1913, and commenced the season's work in township 17, range 25, west of the sixth meridian. There I surveyed suitable grazing lands along Twaal creek, and retraced a part of Cooks Ferry Indian reserve No. 6. This portion of the township is very hilly and broken, and nearly all the land surveyed is suitable only for grazing. There is fair bunch-grass on all the lower slopes. Some benches along the east boundary of the township are cultivated, and the quality of the soil is generally excellent, but the scarcity of water for irrigation discourages more extensive farming.

I next subdivided certain sections along Pimainus creek in township 17, range 24, consisting for the greater part of a narrow valley, which save for some stony bench land in sections 21, 22 and 15, contains no land which could be tilled profitably. There is good grazing along the creek but the sides of the valley might be too steep in places for stock.

Most of this township consists of an elevated plateau, well timbered with fir and jackpine, and is nearly all covered with a good growth of timber grass, or pine grass as it is sometimes called. Unfortunately cattle and horses do not thrive on it, and it is generally considered worthless for grazing. I have been credibly informed, however, that sheep do well on this grass and if this be so, large tracts of the central plateau of British Columbia, which hitherto have been considered worthless, may in future provide a very valuable addition to the food supply of the province.

Deposits of gypsum have been discovered in various places along Pimainus creek. Since this mineral is of small value in proportion to its weight, the expense of transportation is likely to prohibit the development of these claims for a long time.

There are several fair-sized lakes at the head of Pimainus creek in township 17, range 23, which are well stocked with good trout.

On June 10, I moved to Drynoch and began work in township 16, range 25. The right bank of Thompson river was traversed from the north boundary of Cooks Ferry Indian reserve No. 2 to the south boundary of the township; such lines as were necessary to complete the survey of the sections adjoining the river were run and several Indian reserves retraced and tied in. The portion of this township which lies west of the Thompson is very rough and broken, so that it was difficult to run some of the lines.

I also subdivided nearly the whole of the east half of this township, which lies mostly on a rolling and hilly plateau between the Thompson and Nicola valleys. This plateau is generally well timbered with fir and bull pine, interspersed with some open patches; it is nearly all fair to good grazing land, and considerable areas in places, are arable. The elevation averages from 3,400 to 4,000 feet above sea-level, and nothing more delicate than hardy cereals and vegetables can be grown. The Indians on Nicoomen Indian reserve No. 10 raise most of the ordinary vegetables successfully, as well as

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grain, but the latter sometimes does not ripen before the fall frosts set in. There are a number of good springs throughout the township, and while the amount of water is not sufficient to be useful for irrigation, they constitute a most valuable asset for a stock range. Strawberries grow in great profusion, ripening about the first of July. Bands of wild horses range over this plateau, furnishing considerable diversion for the Indians, who often endeavour to capture some of them with but indifferent success. Even when captured young, it is almost impossible to break them. Blue and willow grouse also abound in this district.

Subdivision was extended southerly to include grazing lands in the northeast quarter of township 15, range 25, and such portions of Indian reserves as fell within the lands surveyed were retraced and tied in. Both banks of the Thompson were traversed through this township, and the survey of the sections along the river was completed where necessary.

Miscellaneous surveys along the Fraser, from Lytton to the north limit of the railway belt, occupied practically the remainder of the season. The country there is very mountainous and broken, especially on the west side of the river.

In townships 17, ranges 27 and 28, a number of small benches occur in the sections surveyed on the lower slopes of the mountains. Many of these have been cleared and are cultivated by Indians. These Indians seem to be, as a rule, good farmers. Practically all the suitable land within their reserves is utilized, and they have gone to considerable pains constructing ditches and flumes for irrigation purposes. There is no wagon road along the west side of the river, and any farm produce they may raise has to be brought to market, or at least part of the way, on packhorses. For this reason beans are the principal crop grown, as their value is great in proportion to their bulk, and they stand rough handling well. Until a road is built along this side of the river extensive development cannot take place.

I subdivided such lands along McGillivray creek, in township 18, range 27, as I considered valuable. The best land is a sloping bench in the east half of section 8 and the grazing is generally good throughout this section.

In township 18, range 28, I completed the survey of section 15 including the establishment of half a mile of the north limit of the railway belt, and the traverse of the right bank of Fraser river through this section. Some subdivision was also made on the east side of the river, including some patches of good land, suitable for settlement, in sections 26, 23 and 14.

This portion of the Fraser valley is very suitable for general farming. There are many thriving orchards, and dairying is carried on very successfully by a few ranchers. Bees do well, and give good returns with apparently little attention. The climate is excellent, and there are no summer frosts. This district being in the "dry belt", irrigation is essential, and generally the amount of water available is not sufficient to supply all the cultivable land. In many places this condition of affairs could be improved by constructing reservoirs at suitable places along the streams, wherever dams could be built economically, and thus conserve much of the water which now is lost in the spring.

Considerable prospecting is being done along McGillivray creek, and some fair samples of platinum and gold have been found, but not in paying quantities. Many of the bars along the Fraser are occasionally worked on a small scale for gold by Indians, who generally make fair wages. Several benches of what must have been fine agricultural land, close to the river, have been washed for gold in years gone by, and there is now left only a waste of rounded small boulders and stones. It is doubtful if the amount of gold thus obtained compensates in the long run for such wanton destruction of one of the province's most valuable assets.

After completing a few small surveys near the town of Lytton, I decided to discontinue field operations for the season: the remaining lands to be surveyed were at a considerable elevation and the snow was deep.

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I arrived at Kamloops on December 15, where I discharged the party on the following day.

Although an unusual quantity of rain fell during the summer months, the season generally was very favourable for surveying and the fall was ideal from a surveyor's point of view.

I have the honour to be, Sir,

Your obedient servant,

JOHN A. CALDER, D.L.S.

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APPENDIX No. 20.

ABSTRACT OF THE REPORT OF A. V. CHASE, D.L.S.

SURVEYS IN THE RAILWAY BELT, B.C., SOUTH OF LYTTON.

I organized my party at Kamloops, and on May 22, 1913, we left for township 14, range 27, west of the sixth meridian where our first surveys were to be made.

The valley of Fraser river in this township is narrow and flanked by steep mountains to the east and west, and averages scarcely more than one mile in width. In this valley may be found land suitable for settlement. Small areas of bench land at varying elevations are found throughout the valley and are composed almost without exception of a good quality of light sandy loam soil. Some areas include also a considerable quantity of sandy gravel. The timber in this township is not of merchantable value. It is composed throughout of bull pine and fir up to twenty-four inches in diameter, the quality being generally better to the west of the river. Much of it in accessible places has been cut by settlers but it still covers most of the main valley except in the vicinity of lands which have been cleared and improved. The average size would scarcely be considered of any value for lumbering.

Our next work was in township 13, range 27, and in townships 12 and 13, range 26. The valley of the Fraser through these townships conforms to the general character of the valley in this locality except in the southern part of township 12 where the mountains to the east recede to a greater distance from the river, leaving areas of bench and bottom land as far as two or two and one-half miles from the river. Bench land fit for cultivation was found adjoining the river in the southern part of township 13 and throughout township 12. Considerable settlement has taken place in this neighbourhood and other settlers are waiting for the vacant lands to be sufficiently surveyed for disposal to make homestead entries thereon.

I then decided to move into the valley of Nahatlatch river in townships 12, ranges 26, 27, and 28, and do as much work there as could be accomplished before the uncertain fall weather set in. To this end I moved by wagon to the cable ferry of Messrs. Wordenhoff & Co. at Keefers, B.C., where my outfit was transported across the Fraser. From the ferry I moved to the end of the wagon road by team and wagon, but was disappointed by the non-arrival of packhorses for which I had arranged but which had strayed into the hills. I was able, however, to move sufficient of the outfit into the valley by man pack to supply us with food and shelter for the night, and the next day, August 23, the remainder of the outfit was moved down to the valley by pack horses, and camp was set up in the southeast quarter of section 13, township 12, range 27.

The valley of Nahatlatch river and lakes is essentially, as far as these surveys were carried, a narrow defile between steep mountain ranges to the south and north, but small areas of workable bench land are found along the valley. These when close to the river bottom are inclined to be very sandy and somewhat stony, but such benches as are at a slightly higher elevation are composed of a very good quality of sandy loam and light sandy loam soil. Most of this class of land is found in range 27, the mountains in ranges 26 and 28 rising as a rule from points close to the water's edge. In township 12, range 26, in this valley, are to be found several areas of excellent bench land at from 500 to 600 feet above the river, but this land is nearly all disposed of. Only one bona fide settler was found in this valley west of range 26.

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The timber in the Nahatlatch valley is scarcely of sufficient value to warrant lumbering operations. In the river bottom bull pine, white pine, fir and cedar are found in fair size and quantity, but as the elevation increases white pine and cedar disappear and the timber is composed mainly of scrub, bull pine and fir, with jackpine in the higher altitudes.

This valley can be reached by wagon road from Keefers to the divide between Fraser and Nahatlatch rivers and thence by a good pack trail to Hannah lake, in section 19, township 12, range 27. From this point the pack trail is not fit for loaded horses and supplies must be carried westward on the lakes by means of rafts or dug-outs. At the western end of the lakes the pack trail is again fit for use by loaded horses, and access may be had by it to the western limit of the railway belt.

The physical features of the land surrounding the western part of Nahatlatch lake suggest the advisability of a micrometer traverse, and as I did not have the necessary instruments with me, I left this work to be carried out at a later date.

On October 30, I returned to the Fraser valley to complete before the end of the season certain surveys for which there was an immediate necessity in township 12, range 26, and in township 13, range 27, and on November 28 I moved camp to Lytton to complete some work omitted earlier in the season in township 14, range 27.

This ended my work for the season. I disbanded my party on December 6 and left at once for Orillia, Ont., where I arrived on the 11th.

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APPENDIX No. 21.

ABSTRACT OF THE REPORT OF G. W. COLTHAM, D.L.S.

STADIA SURVEYS IN CENTRAL ALBERTA.

On May 26, 1913, we left Edmonton, where I had organized my party, and proceeded easterly over the Canadian Northern railway to Sickman lake, in township 52 range 13, west of the fourth meridian.

Surveys of lakes in the following townships were completed during the season:—

Townships 50 and 52, range 9, townships 49, 50, 51, and 52, ranges 10 and 11, townships 47, 48, 49, 50, 51, and 52, range 12, and townships 47, 48, 51 and 52, range 13, all west of the fourth meridian. An inspection was made of township 50, range 13, but no bodies of water of sufficient importance to warrant a survey were found. No lakes exist in township 51, range 9, or township 49, range 13.

Sickman lake is surrounded by hills which rise gradually from the shore. About a mile from the southerly end of the lake they attain a height exceeding 100 feet. Small fresh-water springs are found along the shore, and these serve to partially offset the effects of evaporation of the lake water. The lake level, however, has fallen in recent years as the old shore is visible in many places more than a chain from the water's edge. The shore is composed of sand and gravel and rises very slightly for some distance. The water is slightly alkaline, and the greatest depth found was about fifteen feet but soundings indicate that the bed is uneven. The bays are very shallow.

The soil in this township is a sandy loam, and while not very suitable for the cultivation of cereals is well adapted to the production of potatoes and garden vegetables. The greater part furnishes splendid grazing land for cattle and horses. Small scattered areas of poplar, a few acres in extent, furnish fuel to the surrounding settlers.

Township 52, range 12, contains a great many lakes; those in the northerly part are all surrounded with poplar of small dimensions while the shores are obstructed with dry fallen timber. In several small lakes ranging from nine to twelve feet in depth portions of dry trees were standing, indicating that they are of comparatively recent origin.

The surrounding country is rolling, broken by small hills, and not well adapted to cultivation, but furnishes good summer pasture for cattle.

A small lake formerly existing in the southwest quarter of section 7 has entirely dried up, and the old lake bed is covered with grass. The only apparent cause of its disappearance is evaporation, as no surface outlet or inlet is visible. A lake lying in sections 2 and 11 contains upwards of thirty islands, and has only narrow channels of open water. These islands lying a few feet above the water are thickly timbered with small poplar. The lake water though almost free from alkali is stagnant, and is filled with small green particles of vegetable matter which in the presence of the sun's heat impart a putrid odour to the water, and give it a most unpleasant taste. The depth is fairly uniform averaging about ten feet. The shore line is timbered, and low hills rise from the water's edge. The surrounding country is settled largely by Russians and Galicians, who have as yet tilled only a few acres of their farms, the land in fact being too rough and broken for profitable cultivation but well suited for cattle ranching. The soil in general is a light sandy loam.

The lakes in townships 52, ranges 11, 10 and 9 contain water which is almost free from alkali and which, after boiling is quite potable. A lake in sections 19 and 20, range 11, has a hard level bed of sand and gravel and open shores and contains fine clear

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drinking water of temporary hardness. The other lakes are surrounded by small scrubby poplar and have nearly level shores. Many of these lakes are fed by springs which seem to maintain a fairly constant level.

The surrounding country is rolling, and near Vermilion river the hills are rather precipitous. The soil consists of sand and clay loam on which grain thrives but cultivation is difficult. The land is perhaps quite as valuable for grazing purposes. Poplar timber which occurs in scattered areas ranges from two to seven inches in diameter.

Vermilion river drains a large area but in the month of July it was only twenty to thirty feet wide and three feet deep, with a sluggish current. The river valley ranges from ten to twenty chains in width, with abrupt banks rising from fifty to one hundred feet in height. Small scattered spruce and poplar fringe the summit of the bank.

The lakes in townships 51, range 10, and the easterly part of range 11, were found to have dried up considerably, the open prairie country and shallowness of the water promoting active evaporation. The shores are sandy and quite level while the water contains in solution a high percentage of alkaline salts. The depths range from one to four feet and under present conditions these lakes will disappear in a few years.

The country is quite level and well adapted for grain growing although only a very small fraction of the available land is under cultivation. The settlers in this district follow mixed farming and raise a large number of cattle and horses.

In the westerly part of townships 51, range 11, and the northerly part of range 12, the lakes are different in character, having greater depths and being surrounded by rough hilly country, covered to a large extent with small poplar and scrub. A depth of forty feet was found in a lake lying in sections 26 and 35, range 12. This was the greatest depth noted in any lake during the season's work. Dry timber standing in several feet of water near the shore of this lake indicated that the water had risen quite recently. The shore is rough, and covered with dead timber. The water is rather stagnant and slightly alkaline. The small lakes in sections 10, 11, 14 and 15, range 12, contain less than two feet of water and must under present conditions eventually disappear. Incrustations of alkaline salts are found along the shores. The lakes in sections 21, 28, 29 and 33 of this township are quite picturesquely situated and contain clear sparkling water which however is alkaline to the taste.

A lake lying in sections 31 and 32, township 51, range 12, and partly in township 52 was completely dry in the month of June, but contained several inches of water two months later, after the summer rains had fallen. No survey was made as it was thought that it will soon be permanently dry.

The township is similar in its general topography to the one adjoining it to the north. The small town of Ranfurly on the line of the Canadian Northern railway from Edmonton to Vermilion is situated in the southeast quarter of section 15. It has one grain elevator, two stores, and a hotel and a population of about one hundred.

Township 51, range 13, is rolling in character, the land being light and arid, and consequently grain farming is not pursued. It would appear however to be suitable for sheep ranching.

Birch lake extending into townships 50 and 51, ranges 11 and 12, was the largest than two feet of water and must under present conditions, eventually disappear. Incrustations of water surveyed during the season. This lake with a maximum width of nine miles in an easterly and westerly direction, presents so many long inlets connected with the main body by narrow channels, that the amount of shore line is very great compared with the water area. The west shore in range 12 is sandy and the land rises gradually from it. A fringe of poplar extends to within a few chains of the water's edge. The shore line here indicates that the water has fallen three to four feet within the past few years. Several small bays originally connected with the large westerly bay of the lake are now isolated from the main body forming separate shallow lakes with level sandy shores. The land adjoining the shore is rolling, but not too rough for cultivation,

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though it might prove more profitable if used for grazing as the soil is sandy. The farmers in this section have experienced some difficulty in obtaining a sufficient supply of good water. The southerly shore of the lake is similar in its general characteristics to the westerly shore. The land adjoining the inlets of the lake is low and wet during the greater part of the year. In range 11 the land is rolling and in parts too rough for profitable tillage, but furnishes good pasture.

Masses of limestone were found strewn along the north shore in several places, but it is evidently too easily disintegrated by weathering agencies to prove valuable as a building material. A steep precipitous clay bank ranging from fifty to one hundred feet in height extends several miles along the north shore. The small adjoining lakes have evidently been connected originally with the main body. The greatest depth noted was thirty-five feet; this was found at a point a few chains south of the larger island in the large easterly bay extending northward.

A large ranch containing about 6,000 acres comprises the area along the north shore between the two great bays. The greater part of this land is rough and hilly with long narrow coulees affording fine natural shelter for stock in winter. At present about 1,000 acres are under cultivation. Springs of clear hard water are found along the lake shore in section 34, range 11. The lake water is soft containing a high percentage of solids in solution and although alkaline is not unsuitable for stock. Owing to the presence of free ammonia in the water it has been found that fish will not thrive. According to the testimony of the surrounding farmers several of the islands in the lake have appeared only within the last ten years, showing that the lake level has fallen three or four feet at least in that time. The town of Innisfree situated on the Canadian Northern railway in section 2, township 51, range 11, has a population of about four hundred and owing to the proximity of the lake attracts quite a number of summer campers from Edmonton and neighbouring centres.

Townships 50, ranges 10 and 11, consist of open rolling and undulating prairie. The soil is chiefly clay loam and is exceptionally well suited to the production of wheat and oats. All the land open for entry is being farmed, with large areas already under crop.

Townships 49, ranges 10 and 11, contain very rolling land, with good clay soil in several sections; but it is too rough for extensive cultivation. Good farm land is found in the south part of range 11, where the surface is undulating with several quite level sections. Alice lake in this township is evidently slowly drying up; evaporation is very active, leaving the water in the lake extremely alkaline, so that it is even unsuitable for stock. The adjoining small lakes are very shallow and will probably soon disappear. In range 9 the surface is very rolling in character.

Townships 47 and 48, ranges 12 and 13, contain some of the best wheat producing land in Alberta. The surface is level or in places sufficiently undulating to afford good natural drainage. The soil is clay and clay loam which seems especially suitable for the production of wheat and oats, the common crops in this locality. The settlers here are principally Norwegians who have adopted modern, and even scientific farming methods with surprising rapidity and remarkable success.

The town of Viking, situated on the main line of the Grand Trunk Pacific railway, in the northeast quarter of section 36, township 47, range 13, has a population of about four hundred, and is a thriving agricultural centre with three grain elevators, which during the month of November were receiving grain at the rate of 5,000 bushels per day.

Thomas lake, the largest in this district, presents some peculiar features. The depth is variable, while springs of water of a higher temperature than that in the lake rise in various places from the lake bed, which is very soft and composed of alkaline clay and mud. The lake level however appears to be gradually lowering.

The lake in section 10, township 47, range 13, was found to have entirely dried up. Evaporation and cultivation of the surrounding soil appear to be active agencies in

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drying up most of the shallow lakes that came under our observation, while the element of rainfall seems to exert comparatively little effect on the level of many of these lakes. Various large sloughs which according to the testimony of settlers existed four or five years ago have entirely disappeared. In most instances this has proved of great benefit to the farmers as the land now produces heavy crops of good hay.

The lakes on the northerly part of township 52 and the northeasterly part of township 51, range 12, seem to have maintained their present level for a long period, and in a few cases appearances seem to indicate that new lake bodies have been formed comparatively recently.

Game was plentiful throughout the whole area where surveys were performed. Ducks of various species were plentiful on nearly all the lakes and sloughs while flocks of geese frequented the larger bodies of open water. Several flocks of pelican were seen, as well as various kinds of snipe and small aquatic birds which frequented the shallow lakes with open shores. Prairie-chickens were everywhere abundant while a few ruffed grouse were noticed in the timbered areas. Rabbits were very numerous particularly in township 52, range 12. Jumping deer, though not plentiful, are to be found in township 52, range 12, and the vicinity of Birch lake, but no moose are to be found in this region. For feathered game this district is considered to be one of the best hunting grounds in the province.

The weather, during the months of June and July was rather damp, although the actual rainfall was not heavy; but the warmer weather in August and September together with the absence of early frosts which often occur in the district, combined to make the season one of the most favourable that the farmers have experienced for over ten years. It was noticed that in the low flat sections frosts occurred earlier and were much more severe than in the higher and more hilly parts.

The weather conditions however are such as to permit of the raising of practically all the common kinds of vegetables and small fruits, where proper methods of preparation and culture of the soil are pursued.

On November 24, owing to unfavourable weather conditions, operations were suspended.

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APPENDIX No. 22.

REPORT OF G. C. COWPER, D.L.S.

STADIA SURVEYS IN SOUTHERN SASKATCHEWAN AND ALBERTA.

OTTAWA, February 27, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on the stadia survey of lakes carried on by my party in southern Alberta and Saskatchewan during the past season.

I left Welland on May 5, 1913 and proceeded to Medicine Hat, where I organized my party. On the 20th of the month I left for township 9, range 8, west of the fourth meridian, the scene of my first operations. My work consisted of the traverse by stadia of all lakes of a permanent character over five acres in area and the investigation of all lakes and marshes which had dried up since the original surveys or which were likely to dry up. These surveys were carried on in sixty-three townships in Alberta, extending from townships 1 to 22 and ranges 1 to 14, west of the fourth meridian.

From township 9, range 8, I worked east to township 8, range 2. The country passed through is well settled and few homesteads remain to be taken up. Townships 8, ranges 2, 3, and 5, are rougher than the others and are largely under lease for cattle and horse grazing. The remaining townships are homesteaded, the settlers going in for mixed farming.

The only body of water of any importance in these townships is Elkwater lake, in township 8, range 3. This lake is two miles long by a mile and a half wide and is composed of three arms. The deepest sounding taken was twenty-one feet. The water is cool, clear and well stocked with pike. It is prettily situated at the foot of a high wooded hill and part of the south shore is laid out as a summer resort. The lake is only thirty-five miles from Medicine Hat, and as there is a good trail to that city, a large number of people from there use it as a summer resort.

From Elkwater lake I moved south by way of Medicine Lodge coulee to township 1, range 2. This coulee runs north and south and varies from one to two miles in width, with banks from 100 to 400 feet high. The coulee and the land immediately east is well settled as far south as township 5, but from there to township 1 the country is rougher and is practically all under grazing lease, and the ranch houses are widely separated.

Township 1, range 2, is well settled by Americans, who on account of the great distance to the nearest railway in Canada do most of their trading in Montana. This will largely be overcome on the completion of the Weyburn-Lethbridge branch of the Canadian Pacific railway.

Milk River lake in this township is about three miles long and varies in width from ten chains to half a mile. It is very shallow, and at the time of my survey, June 23, contained only a little over a foot of muddy water. In a dry season it will completely dry up, but it will not produce hay.

From this township westerly to Comrey, in township 2, range 6, the country is rough and is sparsely settled with ranchers. From there northerly to Pakowki lake, in townships 3, ranges 7, 8, and 9, townships 4, ranges 7 and 8, and townships 5, ranges 7, 8, and 9, the country is well settled with homesteaders. This lake was originally

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a large body of water. The main body of the lake was ten miles long and from two to six miles wide; it had two long arms, the one at the southwest end being seven miles long and three-quarters of a mile wide, and the other at the northwest end being four miles long and about half a mile wide. It has dried up considerably in the last few years and is very shallow, three feet being the greatest depth found. The land formerly in the lake and now dry is gumbo soil and is covered with foxtail. The water is milky and unfit for use. There are a number of creeks flowing into the lake but there is no outlet.

The country around the lake, with the exception of the north end, where there is a large sheep ranch, is well settled. A large number of Americans, who came into this district in 1910, are following mixed farming, and although at present fifty miles from the railway they are meeting with success. The new branch of the Canadian Pacific railway from Weyburn to Lethbridge runs just north of the lake.

From Pakowki lake I moved to Crow Indian lake, in townships 5, ranges 13 and 14, passing through a well settled country. This lake is about four and a half miles long and 20 chains wide. It is situated in a long coulee about a mile wide with banks about 200 feet high. The greatest depth found in this lake was six feet, and the water is fresh and good. The area covered by water is fairly constant except at the west end where the lake runs out into a long marshy flat. The overflow from this lake reaches Pakowki lake.

From Crow Indian lake I moved north to the town of Grassy lake, in township 10, range 13. For the first ten miles after leaving Crow Indian lake there are practically no settlers, but from there north to South Saskatchewan river the country is well settled. In townships 9, ranges 11, 12, 13, and 14, and townships 10, ranges 11, 12, and 13, only one lake was found to contain water, all the other lakes having dried up. These now form valuable hay meadows.

The next townships investigated were those situated between the main line of the Canadian Pacific railway and Red Deer river and from South Saskatchewan river west to range 12. The largest lake shown on the map for this district is Tide lake which originally covered half of township 18, range 10. This lake was found to be completely dry and its bottom which is gumbo soil was covered with more or less vegetation. I investigated seventeen townships in this district in which all the lakes were dry, and in ten others some of the lakes were dry and some were found to still contain water the year round. The only lake in this district of which special mention may be made is Old Channel lake in townships 14 and 15, range 5. This lake is in the form of a horseshoe and is about two miles from end to end and ten to twenty chains wide. It was evidently at one time the channel of the South Saskatchewan, but the river has cut a new channel. The lake is very shallow, varying from one to two feet deep, but it has never been known to be completely dry.

In townships 20, ranges 4, 7 and 8, township 19, range 3, and townships 17 and 18, range 5, a number of alkaline lakes were traversed. These lakes contained very little water, but their bottoms are composed of very soft white alkaline mud which, even when the water disappears, do not become dry, nor do they produce any vegetation. In some cases the settlers have these lakes fenced off to prevent their stock from becoming mired in them.

This district is becoming very well settled. New houses were noticed going up in all the townships, and new land is being broken. The branch of the Canadian Pacific railway from Swift Current to Bassano runs through this district. Some of the townships are rough and broken and are under lease for horse and cattle ranching. There are no sheep ranches in the district.

The next area investigated was in townships 12 to 17, ranges 1 to 3 inclusive. In these townships about half of the lakes were found to be dry while the remainder still contain some water. These townships, with the exception of townships 14, ranges 2 and



Photo by J. S. Galletly, D.L.S.

Hudson Bay Store and Factor's Residence at Fort Vermilion.

The building in the foreground is the Factor's residence, while away in the background can be seen the flour mill. The store is about half-way between the residence and the mill.



Photo by G. C. Cowper, D.L.S.

Alkaline Mound in Southern Saskatchewan.

This mound, on the shore of a lake in township 16, range 25, west of the Third meridian, is about eight feet high and fifteen feet in diameter. It is snowy white and is composed of clear crystalline salts which on exposure to the air break up into a fine white powder which covers the mound to a depth of about one inch. The mound appears to be formed from salt springs. When the lake fills up the mound dissolves, the salt spreading over the bottom of the lake, and when the lake dries up the mound forms again.

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3, which are rough and hilly, are well settled, mostly by Germans. There are no large or important lakes. A number of summer camps for sheep were seen.

On September 19 I finished the survey of the lakes in township 12, range 1, thus completing my surveys in Alberta.

My surveys in Saskatchewan were confined to the block of townships composed of townships 12 to 16, ranges 20 to 26, west of the third meridian, in which I surveyed and investigated all the lakes. These townships are situated immediately north and east of Maple Creek settlement and the townships are with a few exceptions well settled.

The settlers in this district go in for mixed farming and very few of them depend altogether on the growing of grain. There are still a number of ranches in this block. Township 12, range 23, and township 13, range 20, are both entirely under grazing lease. Township 14, range 24, and townships 16, ranges 23 and 24, are largely composed of sand hills. At one time there was some fairly large timber in these townships, but the settlers have cut practically all of this and now very little except scrub remains. The ranchers in this district raise horses, cattle and sheep.

Crane lake, in townships 13, ranges 22, 23 and 24, is the largest body of water in this district. It is about eight miles long and five miles wide at the widest part. On account of a thin coating of ice I was unable to sound it, but it is said to be twenty feet deep. The water in the lake is slightly alkaline but it is used for stock. The lake is fed by Bear creek and has no outlet. Crane lake has dried up somewhat in the last few years. This is most noticeable on the south side where the land is low and flat.

Bigstick lake, in townships 15, ranges 24 and 25, is also a large body of water, but it is drying up rapidly although it has no outlet. This is accounted for by the fact that the water in Maple creek, which is the lake's only source of supply, is being used for irrigation purposes. The water is also slightly alkaline and the greatest depth found was nine feet. The east end of this lake is very shallow and the land rises very gradually. As the water recedes it leaves good hay lands. In both Crane and Bigstick lakes moderate quantities of pike and sucker are to be found, and both of these lakes are frequented in the fall by a large number of ducks, geese and cranes.

In township 16, range 25, a very unique lake was found. This lake is about two miles long by half a mile wide, and at the time of my survey, October 8, was dry except for a few inches of water at the north end. The bottom of the lake is covered with a coating of hard crystalline and alkaline salt varying from a few inches to a foot in depth. At the south end of the lake there is a large mound of alkaline salt of snowy whiteness, about fifteen feet in diameter and eight feet high, and close to it there is a smaller mound about three feet high. The mounds are composed of clear crystalline salts which on exposure to the air break down to a white powder, and this powder covers the mounds to a depth of an inch. I cut about a foot into the larger mound without finding any change in its composition, but on cutting six inches into the smaller one, water spouted out and continued flowing. On returning next day this mound was found to be again sealed up. These mounds are apparently formed by salt springs, which on coming to the surface deposit the salt. The mounds are said to disappear and to be built up again, and one settler informed me that he had seen five of these mounds at one time. It appears that when the lake fills up in the spring with the fresh snow water and the heavy rains, these mounds are dissolved and the salt is then deposited over the lake bottom.

Vincent lake in townships 14 and 15 range 22, which is approximately the same size as the last mentioned lake has practically the same bed formation, but there are no mounds in it. A number of smaller lakes were examined which had the same hard crystalline salt bottom, but in none of these were any springs noticed.

In sections 30 and 31, township 15, range 20, there is a fairly large lake with a hard crystalline bottom. About twenty chains south there is a much smaller lake without any water but with a very soft white alkaline mud bottom, and about fifteen

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chains east of this there is a fresh-water lake. The lake with the hard crystalline bottom is in a small valley, while the other two are in another valley but they are not connected.

In these townships a large number of lakes were surveyed which were practically free of water but the bottoms were soft white alkaline mud. These lakes carry water so long each season that their beds never become really dry, and vegetation has no chance to grow. In a few cases where the lakes have remained dry, vegetation appeared to be starting.

The deepest lake encountered during the season was Freefight lake, in townships 16 and 17, range 23. It is about two miles long by half a mile wide, and is surrounded by high rolling prairie. It is fed by a fresh-water creek but the lake itself is strongly alkaline. It was found to be over sixty feet deep.

Practically all the lakes surveyed during the season were found to cover a smaller area than they did at the time of the original surveys, from ten to thirty years ago. This may be partly accounted for by the fact that the land is becoming more broken each year, thus allowing the surface water to sink in. Virgin prairie is almost impervious to water.

A large number of the prairie lakes have no well-defined inlets or outlets. They are simply pot-holes, varying from a few acres to a few square miles in area. The surface water from the melting snows and the spring rains fill them and evaporation is their only outlet. As the land becomes more valuable and proper drainage is instituted many of these lakes will be reclaimed for hay meadows and in some cases for the growing of grain.

The one great drawback of this southern country to the homesteader is the uncertainty of the rainfall for the ripening of his crops, and to the rancher the uncertainty of having an abundant supply of fresh water for his stock.

The game consists of ducks, geese and cranes in large numbers, and an occasional antelope in the less settled districts.

As to the accuracy of the stadia for traverse surveys, I would mention that I closed a large number of my traverses by latitudes and departures and found the closing errors in many cases to be little in excess of that which would be expected with a transit and chain. In one case I retraced three miles of a base line with the stadia and differed by only seven links from the theoretic at the end of that distance.

During the season I completed the survey and investigation of the lakes in ninety-two townships and partly investigated eleven other townships.

I completed operations in the field on December 20 and reached my home in Welland on the 24th.

I have the honour to be, Sir,

Your obedient servant,

G. C. COWPER, D.L.S.

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APPENDIX No. 23.

ABSTRACT OF THE REPORT OF A. L. CUMMING, D.L.S.

RESURVEYS IN SASKATCHEWAN AND ALBERTA.

My work during the season of 1913 consisted of resurveys, retracement and restoration surveys of townships, the original surveys of which were performed twenty or thirty years ago.

I organized at Edmonton and shipped my outfit to Strome, Alta., on July 7, 1913. My first work was to renew the monuments adjoining Wavy lake in townships 44 and 45, range 15, west of the fourth meridian. Upon completion of this work I drove by way of Content and Red Deer to Cygnet lake which lies in township 38, range 28. This lake was reported to have been greatly lowered by a ditch which had been constructed by the railway company whose grade crosses this lake. The ditch has lowered the water in the lake by about two feet but has not caused any great change in the shore line, except that in a dry season some valuable hay sloughs would be available. I inspected the monuments surrounding the lakes and replaced a number of iron posts that were missing.

My next work was on the correction line between townships 26 and 27, range 15, where I corrected the positions of the monuments. I shipped most of my outfit to Munson by Canadian Pacific and Canadian Northern railways and drove across country lightly loaded. I passed through a flourishing well-settled farming country. Mixed farming is increasing in every district; this method of farming practically guarantees the farmer a fair year, even if his grain suffers some from an early frost. Due to the poor service over the new road from Stettler to Munson I was able to complete my work before my freight arrived.

I reloaded my outfit at Munson and shipped it to Maidstone, Saskatchewan, where I made a retracement and restoration survey of township 45, range 23, west of the third meridian. The surface of this township is hilly, the northeastern portion being rough. Approximately two-thirds of it is settled, and mixed farming is being carried on extensively. The soil is a good loam from four to eight inches deep with a clay subsoil. There are numerous lakes in this township, one of which is salty, but the majority have potable water. Every settler has a good well. I found the majority of the old markings, but due to the hilly nature of the country they were hard to locate without re-running the lines. I found the original work very good, but practically all the posts had to be renewed.

From this work I moved north into township 48, range 22, where I retraced the southerly two-thirds of the township and traversed the lakes. The surface is gently rolling and covered with willow and poplar bush. There are a number of lakes in the township partly surrounded with good hay sloughs. The water in the larger lakes is fresh. The soil is a light brown loam from two to six inches deep with a sandy subsoil and mixed farming is largely carried on. Every settler has a good well, water being available at a depth of twenty to forty feet. A large amount of breaking and fencing has been done and considerable land is under crop.

On the completion of this work I shipped the outfit to Sprucegrove, west of Edmonton, and drove to my next work which was a small correction survey in townships 50 and 51, range 27, west of the fourth meridian. I then returned to Edmonton and dismissed my party on October 5, 1913.

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From this date until I closed operations on Februray 9, 1914, I was employed on miscellaneous surveys and the traversing of lakes. The first lakes to be traversed were in townships 51, 52 and 53, range 2, west of the fifth meridian. The work progressed somewhat slowly at first due to the scarcity of help and the lack of ice on the lakes, but as soon as the ice would carry us we made good progress. We also had a few days' work in township 55, range 2.

My next work was to survey the townsite of Nordegg at the Brazeau coal mines in township 40, range 15. I lost considerable time in reaching the work due to the unreliable transportation facilities but the railway has reached the mines and regular mixed trains are running now. This country is being rapidly opened up. A number of settlers are locating south and southeast of the Rocky Mountain House district, and a few have homesteaded west of this point along the right of way. The Brazeau Mines company are counting on spending large sums of money in developing their properties and building a model town to be known as Nordegg. The company employs at present approximately one hundred and fifty men and will greatly increase this number as soon as they start to ship their coal. In December, there were thirty-four thousand tons of coal on the dumps ready for shipping. The company has selected an ideal townsite surrounded by magnificent mountain scenery.

Upon my return from the Brazeau coal fields I left by way of Athabaska for Heart lake, situated northeast of lac LaBiche, in township 69, range 10, west of the fourth meridian. There is a great rush for homesteads in lac LaBiche district due to the construction of the Alberta Great Waterways railway to McMurray. A great deal of this country is very suitable for cattle raising and mixed farming. A great number of settlers have already got their title for their farms, but development has been retarded due to the long distance from a railway or a market. A fine class of mixed farming country extends from lac LaBiche, in townships 67 and 68, ranges 13 and 14, south to within twenty miles of the Canadian Northern railway. My next work was in the Cold lake district. There one sees a large number of up-to-date houses and farms. The only drawback is the great haul to a railway or a market. Every settler I met expressed the greatest confidence in the country. The farmers are for the most part going in for mixed farming. This winter has been exceptionally fine and warm, so that farmers were able to keep their stock out for most of the winter. In some localities they did not commence to feed hay until the end of January.

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APPENDIX No. 24.

ABSTRACT OF THE REPORT OF W. J. DEANS, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION OF SURVEY CONTRACTS IN MANITOBA AND
EASTERN SASKATCHEWAN.

On June 2, 1913, I left Winnipeg with my party for Point du Bois via Lac du Bonnet, arriving at the latter place the same evening. I was delayed there two days on account of a breakdown on the tram line running to Point du Bois, so that I did not arrive at my work until the 5th.

The city of Winnipeg has a hydro-electric power plant located at Point du Bois falls on Winnipeg river, and has applied for certain lands above the falls for flooding purposes.

It has been agreed between the engineers of the city of Winnipeg and the department that an elevation of 212 feet above Winnipeg city datum would be required.

In order to deal with the application of the city it was necessary to measure the area in each quarter-section which would be flooded by the dam. To determine these areas the 212-foot contour had to be located on the side of the river and on the islands in the river.

This work was started by the late William Ogilvie, D.L.S., but owing to his death it was not completed.

My first camp was located about four miles above the power station on the south side of the river, and from this point I was enabled to traverse some ten miles of the contour. There are a number of bench marks along the river from which I obtained the height of the water. I then set a water gauge and noted any change in the level; from the water level I obtained the position of the contour.

The land surrounding that portion of the flooded area which I surveyed is mostly rocky, with patches of soil in places, and is covered with a thick growth of jackpine, balsam, hemlock and poplar, varying in diameter from two to ten inches. In many places the windfall was high and the underbrush thick, and as we had to cut lines through this, our progress on some days was very discouraging. The land is of no use for farming purposes, and as the timber is too small and too scattered for lumbering, it could be utilized only for fuel. The waters of Winnipeg river teem with fish and the forests abound with large and small game. There is a saw-mill located at Point du Bois which affords employment to a considerable number of men. The logs are obtained from a point down the river and are brought to the mill in booms. The lumber is shipped to outside points, first over the tram lines owned by the city of Winnipeg to Lac du Bonnet and thence by the Canadian Pacific railway.

The Hydro-electric power plant at Point du Bois is quite extensive, and has been instrumental in reducing the cost of electric lighting to the citizens of Winnipeg and furnishing them with cheap power for manufacturing purposes. Notwithstanding this, it pays at the present time, and, when fully developed will be a money-making proposition for the city of Winnipeg, and will make the city a great industrial centre.

On July 26 I finished the traverse of the 212-foot contour, and on the 28th moved my outfit down to the tram lines, loaded it on and, with my party, went to Lac du Bonnet. The next day I started for Tisdale by way of Winnipeg, stopping on the way at Portage la Prairie to pick up my horses and wagons which had been left near this place. After loading the horses and outfit I proceeded to Tisdale, arriving there on July 31. I was delayed there until August 5 awaiting the arrival of my outfit by freight.

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On the following day I started for township 48, range 10, west of the second meridian, and got as far as Arborfield, where I was delayed by heavy rains. On the 9th I received a telegram instructing me to re-inspect contract No. 7, of 1911. As the telegram stated that it was imperative that this work should be done at once, I immediately returned to Tisdale and loaded my outfit on the train for Bannock, arriving at that place on the 19th. From Bannock I recut an old pack trail to section 33, township 45, range 9, west of the second meridian, and moved part of my outfit there. The land in that vicinity is well adapted for mixed farming. The soil is a black loam, with clay subsoil, and is covered with small poplar, willow and some scattered tamarack. There are numerous open patches of high land, an abundance of hay in the meadows, and good water in the numerous small lakes. The Prince Albert branch of the Canadian Northern railway runs through township 45, affording good transportation facilities. At Bannock and Mistatim stations saw-mills are located which would provide a market for any produce raised in the locality and which furnish employment for the settlers when not engaged on the land.

On September 16, I moved the outfit by train from Bannock water tank to Tisdale, on my way to township 48, range 10, and on the 18th reached Burntout creek, where I was compelled to stay for nearly a week on account of heavy rains which rendered travelling over the trail almost impossible. On September 27 I started for township 48, and after a hard day's travel through mud up to the axle, we arrived late at night within a few miles of where I intended to start work. The next day I moved to section 7, township 48, range 10, and on the following day started to subdivide the northerly two-thirds of this township, which I completed on October 23. There are quite a number of settlers in this township, attracted there by the numerous inducements offered in the way of good soil, plenty of hay for cattle raising, and sufficient timber for building purposes and fuel. Small game is very plentiful and also large game such as moose, elk and bears. Small fruits, such as raspberries, currants and cranberries grow in profusion. The greatest drawback to the settler is the lack of good trails or road. At the present time travelling out for provisions and supplies is attended with a good deal of hardship and inconvenience.

On October 25 I arrived at Tisdale, and on the 27th shipped my outfit to Regina on my way to Buttreß. It was necessary for me to wait in Regina until the car arrived, so that I could get it transferred to the Canadian Pacific railway and billed to destination.

I arrived at Buttreß with party and outfit on November 1.

My work in that locality was to make a restoration and retracement survey, which I finished on November 8, and on the 11th moved to Johnston lake, in township 14, range 29, where I was to make a correction survey. The land in this township is nearly all settled, but as yet the amount cultivated is very small. I did not see any graded roads in the township, but the trails are good. The nearest and most available railway station is Caron, on the Canadian Pacific railway.

On November 17 I loaded my horses and outfit on a car at Buttreß and shipped them to Boissevain by way of Brandon. The outfit and party arrived at Boissevain on November 19, and I at once started for Max lake, situated in township 1, range 20, west of the principal meridian.

My work in this township was to lay out a number of lots along the northerly shore of Max lake in the Turtle Mountain Forest reserve. This lake is situated in the heart of the mountains at an elevation of about 2,400 feet above sea-level, and is two miles long and about the same in width. The shores are mostly sandy or gravelly. In some places the water is shallow, while in other places it is quite deep, so that bathers can choose the water which is deep and cold or that which is warm and shallow. The waters of the lake abound with jackfish, muskallonge, trout and black bass, which are of a very superior quality and flavour. This lake is fast becoming

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a well-patronized summer resort, and, when better known, will undoubtedly become one of the most popular resorts in Manitoba. The lake may be easily reached from Boissevain by automobile or carriage, being sixteen miles distant from that place. I laid out twenty-nine lots, a small parcel for a picnic ground, and a road. These lots are leased at a yearly rental, subject to a building regulation. I completed the work there on November 29, and on December 1 I loaded my outfit and horses on the train and shipped the same to Fishtown siding, arriving there on the 3rd.

My work was to inspect contract No. 23 of 1913. I recut ten miles of trail, moved to the contract on December 6, and finished the inspection of the same on the 12th. We were in that locality during the big game hunting season, but the hunters did not get as far east as we were, preferring to remain within easy distance of the railway track. The moose were very plentiful, and a good many were shot.

There is some good agricultural land in spots throughout this contract. Township 41, range 25, west of the principal meridian, is mostly level, with ridges of poplar and occasional clumps of tamarack and spruce large enough for lumber. The soil is a black loam, with clay subsoil, and there are many meadows which would produce hay for a large number of cattle. The water is good throughout the township.

Township 41, range 24, is much the same as the last described township, with the exception that the hay marshes are more extensive.

Townships 39 and 40, range 24, contain some good agricultural lands, but are better adapted for cattle raising, as there are many extensive hay marshes throughout these townships. Swan lake occupies a portion of the northeast part of township 40, Birch river, Wood river, and Swan river all flow north and east through this township and empty into Swan lake. These streams all have good banks at a sufficient height above the water to afford a means of drainage for the low lands and swamps.

On December 16, I took the train at Fishtown siding for Swan river, where I paid the party off, and after storing the outfit and making a contract for wintering the horses, I started for Brandon, arriving there on December 22.

The season throughout was favourable for field operations. We had a long spell of warm weather which lasted on into December.

On January 5, 1914, I received your telegram asking me to go to Moosejaw, and settle up the survey affairs of the late Mr. C. E. Johnston, D.L.S. I started that evening, and on the 6th was at work on the accounts. I paid off the men, and made a contract for wintering the horses and storing the outfit. Mr. A. D. Stewart, assistant, took all papers and books to Ottawa.

I arrived back in Brandon on January 14.

APPENDIX No. 25.

ABSTRACT OF THE REPORT OF S. L. EVANS, D.L.S.

SURVEYS IN SOUTHERN ALBERTA.

After outfitting at High River I left on May 23, 1913, for township 17, range 3, west of the fifth meridian where my first survey was located.

Work in this township was started on May 26 and was completed by June 7. The surface of the township is open hilly prairie and is rather too rough for agricultural purposes, although in the northern part there are a few quarter-sections that might be worked. The soil consists of a black loam with clay subsoil. Ranching is already carried on in a profitable manner and seems to be the most suitable occupation for the district, not only owing to the roughness of the township, but also to the high altitude. Summer frosts are usual in this district.

My next work was the completion of the subdivision of the parts of townships 16, 17, 18, 19 and 20, range 4, west of the fifth meridian which lie outside the Rocky Mountains Forest reserve. Townships 16 and 17 which were completed by July 24 are very rough and hilly and are covered for the most part with burnt poplar and spruce. A fire in 1910 completely burned over this district leaving very little green timber. These townships lie very close to the Highwood range of the Rocky mountains and farming, especially grain growing, is not feasible. The hills and valleys are covered with a good growth of grass and afford splendid opportunities for ranching which, at the present time, is carried on very successfully; horses and cattle can range the year round. Highwood river crosses township 17. This stream has a very swift current and no doubt in the future, when the district is settled, will offer opportunities for the development of water-power.

Townships 18, 19 and 20, range 4, were next subdivided. This work was completed by the end of September. Ranching is carried on successfully in these townships, but the country is too rough and hilly and at too high an altitude for grain growing. This district has been the centre of an oil rush during the past season. Oil has been found in the "Black Diamond" well at "Black Diamond" in township 20, range 2. From the opinion of geologists it would appear that the strata in which the oil at "Black Diamond" has been found dips upwards and runs in a northwesterly direction. That would put these townships close to the oil deposits. Prospectors have been busily engaged all summer looking for likely locations in this district.

While engaged in the subdivision of township 19, range 4, I moved camp to township 19, range 7, and ran the north half of the east boundary of section 14. A good pack trail runs up the south fork of Sheep river to Burns' coal claims in this township. A railroad is now being located into this district and it is expected that the coal mines will be opened in the near future.

After the completion of townships 19 and 20, range 4, I moved camp to township 23, range 5, and completed the subdivision of the township. Much of the land in this township is swamp, but the settlers along Bragg creek are ranching successfully. No grain has yet been ripened in the district, as summer frosts are frequent, due no doubt to the closeness of the mountains and the high altitude. This work was finished on October 21, after which I took the party to High River where the men were paid off on the 27th.

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From October 27 I was engaged on miscellaneous surveys. A proposed summer resort on Madge lake in township 30, range 30, west of the principal meridian was surveyed and a topographical survey of the area made. This was finished on November 26.

My next work was a topographical survey of a proposed summer resort in township 19, range 19, west of the principal meridian. This was completed on December 12.

I next proceeded to township 26, range 30, west of the principal meridian where a traverse of Assiniboine river was made across this township. This was finished on December 31 and after storing the outfit I left for home arriving there on January 8, 1914.

APPENDIX No. 26.

ABSTRACT OF THE REPORT OF J. A. FLETCHER, D.L.S.

BLOCK OUTLINE SURVEYS IN THE PEACE RIVER VALLEY.

My work during the past season consisted of the survey of the west boundary of range 17, west of the fifth meridian from the twenty-third to the twenty-eighth base lines.

I left Edmonton where my party was organized, on March 3, 1913, and proceeded by way of the winter trail across Lesser Slave lake and through Grouard to Peace River Crossing. From Peace River Crossing we followed Peace river down to Cadotte river. This stream was passable for sleighs as far as the junction of the north and south branches, a distance of about four miles from its mouth. The packhorses were used as much as possible to freight in the outfit, but they were too light for teaming and I considered it advisable not to overtax their strength in view of the expected shortage of feed in April and May. The services of three freighters were therefore secured to supplement the work of the packhorses. One team weighing about 2,700 lbs. was taken from Edmonton through to Cadotte river and their weight was very effective in breaking trail on Peace river. Another team was hired from Athabaska to Grouard. The third took a load of supplies from Peace River Crossing to Cadotte river. From there on, considerable difficulty was experienced in securing sufficient feed for the horses, so they were spared as much as possible. Deep snow rendered foraging difficult and frozen grass at best has little nourishment. The outfit was packed up the north bank of Cadotte river and freighted across country on sleighs to the vicinity of our work. Owing to the deep snow and the extensive windfall and timber in this district trail cutting entailed considerable labour, and freighting was tedious and laborious.

Work was commenced on the line on April 8 and, shortly afterwards the snow disappeared, several warm days from the 10th-13th, leaving only a few patches of snow in the shaded localities. The remainder of the month was fine, and the horses were able to get the dry feed with very little difficulty. Sufficient oats were taken along to last, with careful distribution, till the first grass began to appear, toward the end of May, but before it became plentiful in June, the horses failed considerably and not until well on in July, after a month's feed on the splendid meadows northeast of Carcajou, did they regain what they lost during the spring work. However, the convenience with which we got in as far as Cadotte river and the early commencement of the survey in April well repaid the trouble experienced with the horses in April and May. The work proceeded without interruption till September 26, when the survey was completed.

The fall of 1912 had been quite dry and forest fires had started in several localities. West of Peace River Crossing these fires did considerable damage, burning up large quantities of hay. This caused a scarcity of hay in the succeeding winter and spring around Peace River Crossing, prices rising as high as \$50 and \$60 a ton. What was used was brought largely from Grouard where the price was \$25 a ton. When the snow disappeared in the spring the water went off very quickly, surface water bothering very little. The dry weather which followed caused the fires, which had smouldered in some patches of moss in several localities throughout the winter, to break out afresh in the latter half of May and the first half of June. They were burning in several directions. One of our coaches was barely saved, but in saving it two horses were cut off by the fire and subsequent search did not locate them. Trouble was experienced with

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smoke and also with fires about June 5, but shortly after this, between the 10th and 20th, and at intervals thereafter rain fell very opportunely and checked them. At Fort Vermilion the crops and the gardens received the rain to mature before the frosts in the fall.

The extensive rains which fell between Peace River Crossing, Grouard and Wabiskaw in 1913 were not experienced farther north, where the rainfall was sufficient but not excessive. The growth of all vegetation was very rapid in June and July. The month of August was very pleasant. Light frosts were experienced for three nights, the 15th, 16th and 17th, but they were not heavy enough to damage the wheat at Fort Vermilion; after that date the temperature was steadily above freezing point for most of September, which was a rather wet month. The rains though not heavy, fell often enough to interfere materially with the curing and stacking of hay.

The Hudson's Bay Co. arranged to take the party out, promising to leave Vermilion on October 1 for Peace River Crossing, but owing to indifference on the part of some of the officials, their steamer, the *Peace River*, was unable to pick up the party until the 12th, causing an unnecessary and tedious delay of ten days. The trip was made from the twenty-seventh base, up to Peace River Crossing in six days. The two boats plying on Peace river, are both stern wheelers and burn cordwood. The steamer *Grenfell*, operated by the Peace River Trading and Land Co., was running from Fort Vermilion to Fort St. John on a twenty-one day schedule but was incapacitated in the fall owing to an accident to the boilers.

The party crossed the portage to Grouard, two teams being hired, each taking about 1,000 pounds. This trail was in a very bad condition. Owing to the wet summer experienced here, the trail in places was flooded a great part of the summer. In some places it is clay and is graded to a rather flat crown no special attention has been paid to drainage. The road bed thus becomes soaked with rain and once started, soft holes quickly work bigger. The road has been partially corduroyed, but after the heavy traffic of the last few years this corduroy is largely worn out and worn out corduroy is worse than none. In the fall of 1913, this trail for some considerable distances, was well nigh impassable, being a succession of broken patches of corduroy and bog holes. Numerous settlers came to grief, attempting to go in with their effects and supplies. The trail in the winter is very good, sufficient snow falling and enough traffic passing over it, to keep it well broken for the entire distance. March is an excellent month for travel on this trail.

The Northern Transportation company's boat was used across Lesser Slave lake, the boat going down Lesser Slave river as far as Soto landing. Teams were taken across the portage to Mirror landing, a distance of sixteen miles. Several hard frosts occurred in the latter part of October and on reaching Mirror landing, the Athabaska was found to be running full of drift ice. A gasoline boat operated by Mr. Patterson was used in Athabaska. The water was quite shallow and the presence of so much running ice in the river rendered navigation difficult. However, the boat was solidly made and bumped over the rocks without serious injury. It was driven by side paddle wheels and these wheels lost most of the paddles on the trip down, one wheel being entirely destroyed and only half the paddles being left on the other. The party reached Edmonton on November 3 and was paid off.

Townships 89, 90 and 91 in the vicinity of our line are drained to the southwest and west, largely by Cadotte river which flows into Peace river. Nearing the Peace, its current is swift, and as the bed is full of stones, it forms almost a continuous rapid. The valley itself is from a mile to two miles wide and the banks are quite steep. Little Cadotte river which empties into the Cadotte is about a chain wide and in the upper stretches the current is somewhat sluggish, meandering considerably in a more or less direct valley. Numerous beaver workings, some hay meadows, and some good spruce characterize this valley. Fire has passed through this country in recent years and large areas are covered with windfall. Throughout this region, spruce and poplar up to eighteen inches in diameter, alternate with smaller spruce and tamarack in the

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swamps and muskegs. Probably forty per cent of this district is muskeg, but as Peace river is approached the muskegs become less numerous and extensive. Some hay is to be found along the creeks, especially around the old beaver dams. The height of land between the drainage basin of Cadotte river and Cache creek to the north is passed in townships 91 and 92. Several lakes and some sloughs were passed there and creeks thread the most of the country. After draining and clearing, this district would be suitable for agriculture.

Townships 92, 93 and 94 are somewhat freer from muskeg, although stretches of swamp are to be found. The drainage in these townships is largely to the north and parallel to Peace river. The basin of Cache creek is good loam. In townships 95, 96, 97 and 98 between Cache creek and Peace river a large area of light soil with ridges of jackpine and brulé, interspersed with sloughs is to be found, but it is generally too light for good agricultural land. East of Cache creek in the same townships some very good land was seen, and also some rich land bordering Wolverine river. In townships 100 and 101, there is some good merchantable spruce up to thirty inches in diameter near Wolverine and Buffalo rivers. In range 16, there is some open land with rich vegetation and a few meadows. Townships 102, 103 and 104 are quite lightly wooded, and could be easily settled. Hay meadows are numerous and extensive.

The survey line passed about six miles from the Buffalo Head hills, where the country is rough and broken. After crossing Peace river in township 105, an area of light soil, jackpine ridges and interlying swampy meadows with numerous sloughs and lakes extends northward for seventeen or eighteen miles. This area extends in a northeasterly and southwesterly direction being bordered roughly by the trail from Keg river to Fort Vermilion. This trail is a wagon road as far as range 18 and west of there it is a good pack trail. The branches of Boyer river have numerous beaver dams. In August there was practically no current in either of the branches northwest of the Keg river trail. The country drained by these branches is good agricultural and grazing land. Hay meadows are numerous and the country is practically free of muskeg.

During the season, several moose and bears, both brown and black, were seen. Foxes and wolves were observed several times in the vicinity of the twenty-seventh base and beaver and muskrat workings were seen in many places. Fur-bearing animals are sufficiently numerous in this country to make fur trapping so attractive that several members of my survey party returned to the lower Peace river to trap during the winter.

In township 105, just north of the twenty-seventh base line some fossilized remnants of trees were found. Shale outcroppings were also noticed at the edge of Peace river in this district.

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APPENDIX No. 27.

ABSTRACT OF THE REPORT OF L. E. FONTAINE, D.L.S.

MISCELLANEOUS SURVEYS AND INSPECTION OF CONTRACTS IN THE PEACE RIVER DISTRICT,
ALBERTA.

I left home on May 20 for Edmonton, Alberta, where I outfitted and organized my party. On June 11, I left for Spirit River settlement, travelling by the Canadian Northern railway to Athabaska, thence by the Northern Transportation Co.'s steamer to Grouard, at the west end of Lesser Slave lake, and from there on by means of my own transport to our destination, which we reached on July 8.

As a number of squatters had located on the unsurveyed part of township 78, range 6 west of the sixth meridian, subdivision in this township was urgently required. While running the necessary outlines, I noticed that the south third of township 79 range 6 was also well suited for settlement, I therefore, decided to subdivide it. I completed the surveys in these townships on September 15.

The next surveys undertaken consisted of the examination of partially dry lake beds in townships 71 and 72, ranges 5 and 6, together with the surveys of four islands along the course of Wapiti river in township 70, range 7.

On the completion of these surveys I was advised that survey contracts in the district were ready for inspection. I therefore inspected contracts Nos. 3, 1 and 2 of 1913, in the order mentioned, and then returned to Peace River Crossing where I arrived on December 9.

While in that vicinity I ran that part of the east outline of township 83, range 22, west of the fifth meridian, not already run and completed the subdivision of township 84, range 21. I suspended operations on January 7, 1914 and left for Edmonton where I arrived on the 17th.

The district through which I worked appears to have a great future in store for it. Great changes have taken place during the past twelve months and if railway construction progresses as rapidly as expected this part of the country will soon have the benefit of railway facilities which should greatly assist in its future development, and afford innumerable openings for private enterprise.

APPENDIX No. 28.

ABSTRACT OF THE REPORT OF J. S. GALLETLY, D.L.S.

SURVEYS IN THE FORT VERMILION DISTRICT.

The greater part of my work, during the summers of 1912 and 1913 and the intervening winter, consisted of the subdivision of townships in the Peace river valley in the vicinity of Fort Vermilion.

On February 12, 1912 I arrived in Edmonton where I organized my party.

Supplies sufficient for eighteen months were ordered, the major part being shipped direct to North Vermilion. Some difficulty was experienced in getting men to hire for the length of time desired. This may have been partly due to the fact that there were several other parties organizing at the same time, and that I could offer only the same rate of wages as those who were going out for one season. Finally, however enough men were found willing to engage for two years' work and we were able to make a start on the afternoon of February 28.

My assistant, Mr. J. H. Patterson was in charge of the party till they reached Athabaska. In the meantime I settled my affairs in Edmonton and then proceeded to Athabaska arriving there before the outfit and in sufficient time to arrange accommodation for it. I engaged freighters there to take us to Peace River Crossing. Mirror Landing was reached on the 7th. and Sawridge two days later. At the latter place we pitched camp and made a survey of Dog Island in Lesser Slave lake opposite the entrance to Lesser Slave river.

This survey with its connection to the township in which it lies occupied about two days, and we were able to proceed on our way on the morning of the 13th. The trails were good and we had but little difficulty in reaching Peace River Crossing, where we arrived on the night of March 19.

Next day we commenced work, retracing part of the survey of the Peace River Landing settlement. The following afternoon I went to examine the north boundary of section 19, township 83, range 21, to see if conditions on the ground were such that a road could be opened up, by producing this line through lot 41, of the addition to Shaftesbury settlement. Such a road would run over the high bank of Peace river. As it was with difficulty that my assistant and I walked up this hill at the point where the line would cross, I concluded that I would not be justified in putting this line through.

Navigation on Peace river usually opens about the beginning of May, so that I had at least five weeks in which to work in this vicinity before I could proceed to Fort Vermilion. With this in view I laid out the work in what seemed to be the most advantageous manner.

While the packers went to Spirit River settlement for the remainder of our transport outfit, I employed the rest of the party in running the north boundary of township 83, range 21. On the return of the packers we moved north to run the east boundary of township 84, range 21.

In the meantime I was trying to arrange for some means of transport to take us to Fort Vermilion. I was strongly advised against rafting and there was only one scow in the vicinity. The price asked for this was \$400.00 which I considered unreasonable: moreover it was not large enough to take all the outfit. After some delay I obtained the use of two scows which were brought from Fort Vermilion by the steamer, but they

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did not arrive until late in May and it was June 1 before we could start on our journey north. Before leaving Peace River Crossing we completed the south third and all the portion west of Peace river in township 84, and the north third of township 83, range 21, together with a school site and a site for the Church of England mission. I would have preferred to have made the last two rectangular in shape but conditions on the ground were such that to have done so would have been to defeat, to a great extent, the purpose for which they were intended.

We were fortunate in our passage to Fort Vermilion, as we took only three days and a half to make the journey of 300 miles. We travelled continuously day and night, with the exception of two stops of about six hours each, one when we tied up the first night and the other when a strong head wind drove us into the bank and compelled us to stay there till it subsided.

We arrived at North Vermilion on the morning of June 5, and after we had unloaded and stored our supplies in a warehouse lent us by Messrs. Revillon Freres, I returned the scows to the Hudson's Bay Co. across the river. Next day we moved into township 109, range 13, to commence subdivision.

My next step was to endeavour to locate the different settlers who were occupying unsurveyed lands in this district. The settlers themselves lent no aid in this matter: they were at first not only indifferent, but in some cases actually tried to avoid the survey altogether. It was not until late in the summer that I acquired a fair knowledge of their approximate positions. As I found that they were stretched over a range of territory from township 107, range 15, to township 109, range 11, and nearly all close to Peace river, I thought it best to leave this part of the work till the river was low.

We continued the subdivision in townships 109, ranges 14, 15 and 16, as we found a good stretch of country just north of the south branch of Boyer river, and as part of the first and last of these townships was desired for Indian reserves. By the beginning of October our surveys had reached Prairie point, in township 107, range 15, and from there we gradually worked our way along Peace river as far as township 109, range 11, surveying all the lands actually occupied. It was not till July of the following year that this work was completed.

In March, 1913, I sent a small party, in charge of my assistant, to traverse Boyer river, and in June I took another small outfit and went back to do the mounding we had left during the winter months.

Our horses were wintered at North Vermilion, as this was the most central point, and it was also the base of our supplies. Stable accommodation was scarce and therefore expensive, so that when Revillon Freres offered to provide the land and the logs for a stable and give us the use of the building on condition that we would provide the floor and roof and perform the labour, I accepted the offer. The season of 1912 was poor, and I had considerable trouble getting the amount of hay necessary to put the horses through the winter.

In July, 1913, we left Fort Vermilion to go to the post at the junction of Mikkwa (formerly Red) and Peace rivers, in order to survey some land in that vicinity which were desired for an Indian reserve. While passing the Vermilion chutes, I was met by a settler there who asked to be included in the survey. In order to do this I had to omit part of the work on the reserve at Fox lake.

We arrived back at the Vermilion chutes at the beginning of September and surveyed here a sufficient area to include one settler, though we were unable to include his partner, due to the latter's absence at the time of the survey.

During that month I received information that a guide whom I had engaged to take me overland to Trout lakes, was sick and would be unable to accompany me; I therefore had to arrange to have my party taken out by steamer over the usual route.

With the expectation that a steamer would be leaving Fort Vermilion for Peace River Crossing on September 27, we left the chutes on the 20th for Fort Vermilion,

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and arrived there on the 26th. Our information was incorrect, and after waiting in vain for a steamer we left Fort Vermilion in company with J. R. Akins, D.L.S., and his party on October 4. The steamer passed us on the 6th on its way to Fort Vermilion, and picked us up on its way back on the 12th, permitting us to reach Peace River Crossing on the 17th. We had difficulty in obtaining teams to take us to Grouard, but we managed to leave on the 19th. The trail was in bad shape, and it took up seven days to make the trip of ninety miles. We left Grouard on the 28th, and after considerable trouble reached Edmonton on November 3.

Most of the country surveyed at Peace River Crossing was very rough, and would be suitable only for grazing or mixed farming. The surface is covered usually with poplar varying in size from scrub to about twelve inches in diameter, with willow underbrush and occasional spruce. The soil, which is second-class, usually consists of about four inches of black loam overlying a stiff blue clay. On the west bank of Peace river, just north of Peace River Crossing, there is an extensive outcrop of sandstone of reddish colour which is suitable for building material.

At Fort Vermilion, most of the country is covered with a growth of poplar varying in size from scrub to about fifteen inches in diameter, with willow and spruce, the latter reaching a maximum of about twenty-four inches. Some open patches occur in every township surveyed, but with the exception of townships 109, ranges 11, 14, 15 and 16 they are almost entirely taken up by the present settlers. The greater part of the settlement is in townships 108, ranges 13 and 14 and many farms can be seen there which would do credit to a community much nearer railway communication.

The country is generally level, the only hills being on the banks of Peace and Boyer rivers, where they are seldom more than fifty feet high. With the exception of township 109, range 11, there is a good wagon road leading into each township from one of the settlements.

The soil which is a light sandy loam except on a few river flats where the black loam is found to a considerable depth, is usually about four inches deep overlying a sandy clay mixutre. It is especially a wheat-growing soil, and it has in some instances yielded large returns. There is a slight amount of alkali all over the district, but in the majority of cases, it does not seem to produce evil effects.

It has usually been assumed that wheat can be grown successfully there every season, but this is open to doubt. The crop for 1912 amounted to about 500 bushels, an average of less than one bushel for each acre sown. This was due mainly to lack of rain, but a severe frost in July did not improve matters any. Mr. R. Jones, who is in charge of the experimental farm at Fort Vermilion, states that wheat can be successfully raised every season and that lack of methods suitable to the needs of the district is the cause of most failures. Those in charge of the Roman Catholic mission, however, state that a crop is sure only once in five years, and the evidence would indicate that this is more nearly correct.

On account of the recent failures of the wheat crop, the flour mill of the Hudson's Bay company has been temporarily shut down.

Oats seem more difficult to raise than wheat, but barley is probably the surest of the grain crops. Rye has never been tried in this district. Potatoes, turnips, mangolds, carrots, sugar beets, cabbage, cauliflower, and celery do exceedingly well. Tomatoes ripen occasionally. Small fruits such as currants, raspberries, etc., thrive, but strawberries have not been successful. Flowers are among the successes of the district, and many varieties are to be seen blooming in the garden of the experimental station at Fort Vermilion. Timothy and broom grass grow well, but alfalfa is always a failure.

Slough hay or upland hay is difficult to obtain anywhere near the settlements and most of the settlers are drawing their hay from a considerable distance.

Horses, cattle and hogs are plentiful in the district and do exceedingly well. Considerable numbers of the horses rustle all winter, but it is usual to feed the cattle during the extremely cold weather.



Photo by J. S. Galletly, D.L.S.

Flour Mill at Fort Vermilion.

This flour mill, built and operated by the Hudson's Bay company, is said to be the farthest north flour mill in America if not in the world.



Photo by J. S. Galletly, D.L.S.

Bringing a Scow up Vermilion Chutes.

These chutes or falls are situated on Peace river about fifty miles east of Fort Vermilion. The total fall is about twenty-four feet, extending over a mile and a half; the falls consist of two rapids and one perpendicular drop, each of about eight or nine feet. Unloaded scows run down the chutes easily, but are seldom brought back, as the expense of taking one up is about as great as making or purchasing a new one.

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At the present time these animals may be purchased at a reasonable price, but any sudden demand would cause the price to rise considerably. Chickens are successfully raised in this district, but wolves, coyotes, foxes and dogs are too plentiful at present to permit sheep-raising.

One has to go a considerable distance from the settlement to obtain much game, but we saw signs of mink, marten, weasels, foxes, coyotes and wolves. Black bears and moose were seen on several occasions. Ducks, prairie-chickens, ruffed grouse and ptarmigan were the only feathered game seen.

No coal of any kind was seen but wood is everywhere plentiful for fuel though in some of the most settled parts of the community it has to be hauled a considerable distance.

No minerals of economic value were found, but there is a deposit of clay suitable for making brick, which has been used for that purpose within the limits of the settlement survey at Fort Vermilion.

The summers are comparatively cool and of late years have been remarkably dry, too dry in fact to permit successful crop raising. The temperature does not often exceed 75 degrees F. in the shade. The shortness of the season is compensated for by the long daylight which in the middle of the summer lasts about twenty-two hours.

Seeding commences about the first of May, and haying commences about the middle of July. By the end of September the weather turns decidedly cold and winter may be said to start with the beginning of October. Until Christmas the weather is not often excessively cold, though one may expect to see the thermometer register 40 degrees below zero occasionally. January and February are excessively cold, and temperatures from 30° to 70° below are prevalent during these months. In March the temperature rises, but owing to the high winds which prevail we found this the most trying period of the winter. By the end of April the snow is usually all gone even in the bush.

The average depth of snow during last winter in sheltered spots and in the bush was about eighteen inches, but on Peace river and on some of the open places the snow drifted to a considerable depth.

Mosquitos, black flies, and bull-dog flies are numerous in summer especially in swampy parts of the country.

The country surveyed near Mikkwa (formerly Red) river is poor. In the vicinity of Fox lake immense quantities of hay could be cut and this township would be best suited for ranching. The remaining country surveyed in the vicinity of Mikkwa river is largely flooded, the creeks having been dammed by beaver.

There are immense deposits of limestone at the Vermilion Chutes in township 108, range 6.

Peace river which flows through a large part of the country in which we worked varies in width from half a mile to about two miles, and its depth in places will reach fifty feet. It is open for navigation from about May 15 to October 15. Above Vermilion chutes the current is about three miles an hour, between the rapids and the chutes it is about six miles an hour and below the chutes about two miles an hour. Immense quantities of power can be developed at the chutes. Boyer river which empties into the Peace in township 109, range 12, will average about a chain wide and its depth will vary from a few inches to ten feet. Fish are scarce in these rivers, but can be obtained in large quantities from the lakes in the Caribou mountains about sixty miles from Fort Vermilion.

The Roman Catholic mission at Fort Vermilion in addition to the regular church work, conducts a boarding school for the children in the neighbourhood and there is a small hospital ward in their school building. The Church of England mission conducts two schools, one at Fort Vermilion and one at Stony point, seven miles from Fort Vermilion.

The Hudson's Bay company have a modern grist mill, and also a small saw-mill at Fort Vermilion.

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Mr. Sheridan Lawrence also has a small sawmill and grist mill, and rough lumber may be purchased at \$20 per thousand feet b.m. The Roman Catholic mission has small mills but these have not been in operation for some time.

The best route for a settler to take to Fort Vermilion is via Peace River Crossing. From Athabaska the usual route is followed along Athabaska river to Mirror Landing, then up Lesser Slave river to Sawridge, across Lesser Slave lake to Grouard, then overland to Peace River Crossing. From this point Peace river is followed to Fort Vermilion. A settler with an outfit will find it to his advantage to make the trip to Peace River Crossing in winter. He should arrive there not later than March 20, in order to take advantage of the roads when at their best, and also to get a raft assembled and ready to be put in the water when the ice goes out. It is the custom of the trading companies to send loaded scows from Peace River Crossing to Fort Vermilion on the first open water, and a settler with his raft and outfit ready could follow in their wake thus saving the expense of a guide. Rafting on this river is not to be recommended for a very large outfit. In such a case it would be advisable to ship by the steamers which ply on the river, or to obtain the use of scows if possible. The distance from Peace River Crossing to Fort Vermilion by river is 300 miles, and it usually takes six days on a scow or two days on the steamer to make the trip.

The Provincial Government has voted a sum of money to be spent on cutting a winter trail from Fort Vermilion to Trout lakes where it will connect with the winter trail from there to Athabaska, but this route is not yet open.

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APPENDIX No. 29.

ABSTRACT OF THE REPORT OF G. H. HERRIOT, D.L.S

BASE LINE SURVEYS IN NORTHERN MANITOBA.

My work during the past season consisted of the survey of parts of the eighteenth and nineteenth base lines west of the principal meridian.

I left Edmonton on February 20, 1913, for the purpose of taking in supplies to a point near the eighteenth base line. These supplies were purchased in Winnipeg and shipped over the Canadian Northern railway to Pas. I left Winnipeg for Pas on the 28th, arriving there the following day. I at once arranged with McMillan Bros., contractors on the Hudson Bay railway, to have my supplies freighted out along the right of way to a suitable point, where I proposed to cache them. It was, however, not until March 10 that three teams finally left Pas with my freight. The intervening time was spent in securing, from Hudson Bay railway engineers, prospectors, trappers and guides familiar with the country near Setting lake, all the available information covering this district, and preparing therefrom such sketch maps as were deemed useful. The Northwest Mounted Police also furnished me with a record showing the earliest dates at which dog travel was possible in this region, for a period of several years prior to 1913.

Just here it may be pointed out that wherever a surveyor is dependent on the waterways of a country for his transportation any time spent in securing maps and information covering the area is well spent. It may save many long, round-about trips and much advance exploration on the part of the canoe men. The maps covering Northern Manitoba are in places very incomplete and very inaccurate and any additions, that can be made to them through the knowledge of those who have travelled new routes and waterways are to be strongly advised. It might also be suggested that a surveyor going into this district should familiarize himself with all the available reports covering this district.

On March 18 the freight reached McMillans' cache No. 13 at mileage 141 from Pas. I decided to leave my supplies in their care at this cache for two very important reasons. First, because it was located near where the eighteenth base line was expected to cross, and on the bank of Goose creek, a small stream navigable for large canoes from this point to the nineteenth base line, and second, because the supplies would be ensured against the danger of loss from thieves and fire, both of which were grave dangers in the vicinity of the right of way.

I went along with my freight in order to make sure that it would get through as far as I desired, and to be certain that such perishable supplies as the dried fruit and meats were properly cared for. In addition I hoped to add to my knowledge of the character of the country by personal observation.

After caching my supplies I returned to Pas, arriving there on March 24 and two days later left for Winnipeg which place I reached on the 27th.

On May 16 I again left my home for Winnipeg in order to organize my party so as to be ready for the departure of the first boat to cross lake Winnipeg.

On May 24, with a party of nineteen men, I left West Selkirk and after a rather exciting trip through large ice floes, we reached Warren's landing on the 26th. The Hudson's Bay company's boat did not arrive until the 28th, when we were permitted to load a small portion of our freight and my party in a York boat, and to tow my canoes behind. In this way we were towed down the Nelson, across Great Playgreen lake, and down the east branch of the Nelson to Norway House. The next two days

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were spent in getting the remainder of the freight down to Norway House and storing it, and in trying to hire Indian guides to assist us down the river.

No Indian guides could be secured so we were compelled to find our way down the river to Cross lake the best way we could. My transport consisted of six large canoes and one small one. These carried about a month's supplies together with the surveying outfit and the camp equipment. At Cross lake I was able to engage two Indians as guides and on June 6 we proceeded down the Nelson, reaching the point at which the principal meridian crosses Sipiwesk lake, the following day. On the 9th my Indian guides piloted us up small winding creeks and across a small lake to our first camp, within a quarter of a mile of the northeast corner of township 68, range 1, west of the principal meridian.

This corner falls in a deep creek and is marked by a witness monument eight chains south. On June 10, after first retracing a mile of the meridian, the eighteenth base was turned off as an offset line, nine chains south of its theoretical location. After producing this offset line about half a mile west it was possible to turn north to the true base line. This was first opened back to the meridian and then its production westward was commenced.

The first thirteen miles of the base line entailed man packing, but the canoes were able to loop around from the end of the base line to a small lake, about the middle of range 1, which they entered by way of a small creek from Sipiwesk lake. Again supplies were brought by the canoes to within a mile of the muskeg lake in range 2. From the crossing of the first bay on Sipiwesk lake in range 3, until Bear island was reached in range 4, the canoes were used to shift camp, the next camp being made on Duck lake, which was reached by a mile portage from below Red Rock rapids on the Nelson over the height of land to Duck lake. A 300 yard portage from Duck lake to the Nelson below Duck falls, made it possible to use canoes as transport from this point until our last camp was reached on an island, near the eighteenth base line leaves the upper bay of Sipiwesk lake in range 6. There it was found that further production westward would entail a great deal of man packing and as the nineteenth base line offered excellent canoe routes, I decided to proceed to it immediately.

The following day we started across Sipiwesk lake, and down the Nelson on our way to the nineteenth base. We packed across Cross portage, which is one and a half miles long, put our canoes into a small lake connecting with Landing lake and following westward along the south shore of Landing lake, we reached the point where the principal meridian crosses that lake about noon on August 11.

The northeast corner of township 72, on the principal meridian, falls in Landing lake and is marked by a witness monument four chains south of its true position. On the afternoon of August 11, the nineteenth base was turned off as an offset line three chains south and parallel to its theoretical location, and produced across a bay of Landing lake. For the first ten miles of this base line canoes were used to transport the camp and supplies, the camp being moved frequently to bays of Landing lake in order to keep close to the end of the line. From Landing lake everything had to be carried one and a quarter miles across Thicket portage into Wintering lake, and the next fifteen miles of line were produced from camps located on small creeks flowing northward into Wintering lake. During the survey of the next six miles back-packing being necessary, only enough supplies were carried to last until the line should reach Halfway creek, in range 5. While the line was being opened across this stretch, the four canoe men were engaged taking the canoes and some of the freight around by Wintering lake across two very wet portages, one and a quarter miles in length, into Paint lake and thence up Grass river and Halfway creek to our anticipated crossing. The canoe men had each to handle a large canoe and tow a small canoe. In crossing Wintering lake they encountered a very heavy wind, and the small Peterborough canoe broke its tow line and was swamped, attempts to recover it proving futile. Halfway creek and Grass river were used for moving camp until the last crossing of

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a bay of Grass river in section 34, range 6, was reached. From this point man packing was again resorted to, although an attempt was made to bring in supplies by Soab creek and Frozen lake.

On October 11, the nineteenth base line had reached a point about thirty-five chains west of the northeast corner of section 35, township 72, range 7. The muskegs in ranges 6 and 7 were very wet, and the snowfall on October 10 so protected these from frost that a delay seemed inevitable. This combined with the rapid approach of winter, made it advisable to close operations on the nineteenth base line and to return to the eighteenth where it had been discontinued on the west side of Sipiwesk lake. It was therefore decided to start back on October 13. The party returned over the first stretch, back-packing the necessary supplies, consisting of the camp equipment and surveying outfit, to a point where the canoes had been left. Four of the party made the trip to Frozen lake about three miles south of the northeast corner of township 72, range 7, where they picked up one of the canoes which had been left at that point, and started to make their way to the mouth of Soab creek. Ice was soon encountered, however, and they were compelled to leave the canoe and back across to Grass river, where they met the remainder of the party with two large chestnut canoes. From this point on the progress was very difficult, it being necessary in places to drag the canoes over the newly-frozen ice. Finally, however, the canoes had to be left behind and along with them the iron posts, instruments, and part of the camp equipment. The remainder of the outfit, including the men's beds, sleeping tents and enough supplies with which to reach the right of way, had to be back-packed. Several days of very trying travel ensued, caused by the heavy loads and the many wide detours around open lakes or bays. Not infrequently men broke through the ice on the lakes, each of which was a source of danger and delay. However, on October 20, the Hudson Bay railway was reached at a point not far distant from McMillans' cache No. 14. The following day the party arrived at cache No. 13, where an abundant supply of food was stored.

In September while still at work on the nineteenth base line the cook and two Indians left the party thus reducing it to seventeen men. Moreover, the Hudson's Bay company wrote advising me that it was impossible for them to purchase the dogs I had asked for. It was therefore necessary for me to go to Winnipeg in order to purchase my transport outfit for winter work and to hire more men. Accordingly on September 14, I left the party in charge of my assistant and proceeded to Winnipeg, where I engaged five more men and purchased a number of dogs.

On October 3 I left Selkirk with my men and dogs and after many vexing delays arrived at McMillan's camp near Sipiwesk lake, on the 15th. Great difficulty was experienced in getting across Sipiwesk lake owing to the formation of ice in the bays and the calmer water of the lake. By October 20, we were able to get twenty-one dogs and the freight across the lake to a point a short distance west of where the Nelson flows from Duck lake. There we found that the whole western arm of Sipiwesk lake had already frozen, so that we could proceed no farther with the canoes. We therefore, endeavoured to return for the remaining ten dogs, but we found that the ice had formed so rapidly in our wake that immediate return was impossible. We accordingly cached the canoes, loaded most of our freight on the toboggans and started westward across the long bay of Sipiwesk lake to where the eighteenth base line leaves it. After a rather perilous passage during which the toboggans broke through occasionally, and frequent portages had to be cut out over different points in order to avoid the weak ice, we managed to reach the west shore by evening. The following day we proceeded due west, with two men cutting trail ahead of the dogs and on the evening of October 22 we reached cache No. 13, where the remainder of the party was awaiting us.

The following day the dog teams went north to pick up the outfit which the main party had been compelled to leave behind. New trails had to be opened so that it was

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not until four days later that the teams returned. The next day the outfit was moved east to within a mile and a half of what was then the end of the eighteenth base line. Each man had to pack his own dunnage as the transport was unable to handle everything in a single trip. On the 28th the production of the line was begun and the work went steadily forward without delay until January 5, 1914, when the northeast corner of township 68, range 17 was reached.

During this period of the survey, dog transport was used throughout. The supplies were hauled from McMillans' cache No. 13 and the dog feed consisting of fish was hauled from a cache on Setting lake. Six dog trains handled by four dog drivers were used during the first six weeks, and from then till the end of the survey five teams were used. The trips after supplies and feed were so arranged as not to interfere with the regular work of moving camp.

As soon as Setting lake was sufficiently frozen for fishing I started two of my regular men at work fishing for dog feed. The fish were very plentiful and by December 12, working with about a dozen nets, they were able to catch enough fish to supply the dogs till the survey was completed. About 4,200 fish, mostly whitefish, were taken during this period. Although the work of fishing reduced my party by two men, it was by far the cheapest method of securing dog feed. Moreover, it assured good wholesome feed and this kept the dogs in condition to handle the transport. As stated before, the northeast corner of township 68, range 17, was reached on January 5. As the supplies were then practically exhausted, and the limit of economical haul for our transport had been reached, it was decided to close operations. Accordingly on the following day we started for Pas which we reached on the 10th. There the men were paid off, each being allowed his time and fare to Winnipeg.

Taken as a whole the season of 1913 was only an average one for survey work. The months of July, August and September were decidedly wet, daily showers being quite the usual order. The month of October was exceptional as during the early part several snow storms were experienced, the heaviest of the year occurring on the 10th. On the 12th, the smaller lakes and creeks began to freeze up and by the 20th many of the larger lakes and swifter streams were frozen hard enough to be crossed by the dog trains. The heavy snowfall before the freeze-up so protected the swamps and muskegs that these did not freeze solid until near the end of November. The period following this heavy snowfall and until the muskegs became frozen was far from pleasant for work, as the men were constantly breaking through, but from the end of October until the completion of the survey in January the weather conditions were the very best. It is worthy of note that the freeze-up in 1913 was about six days earlier than any previous record for twenty-five years. The country traversed by the nineteenth base line in its production across the first six ranges is fairly uniform in character, except that it is much broken by large lakes, such as Landing, Wintering and Paint lakes. Ranges 1 and 2 are very similar in character. The surface is generally rolling and mostly dry, except along the shore of Landing lake, where it is more broken. The soil is a clay loam suitable for agriculture. The greater part of this area has recently been burned over, the surface soil being badly burned. To the north of the base line the country is broken by Landing lake, a beautiful rock-bordered lake about thirty miles long and from a half to one and a half miles wide, with a few deep bays breaking its otherwise regular contour. This lake is reached from Nelson river by way of Cross portage which is one and a half miles long, and from Wintering lake to the west, by way of Thicket portage, which is one and a quarter miles long. The surplus water of the lake finds its way into the Nelson to the east through Landing river. In section 32, range 2, the west shore of Landing lake is reached and from this point westward the timber is dense and consists of spruce, jackpine, poplar, willow and birch, with tamarack in the low places. Townships 73 and 74 in ranges 2 and 3, are much cut up by Wintering lake, with its many deep bays. This lake has a most irregular shore line with two deep bays, about eight miles long extending southwest. It is approx-

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ately sixteen miles long and averages about two miles wide. Many islands add to its picturesqueness.

The surface of ranges 3 and 4, in townships 73 and 74, is more broken by rock ridges which frequently rise to fifty or sixty feet above the surrounding level. Adjacent to Wintering lake the Huronian rocks outcrop in many places. The soil in the less broken areas is clay overlaid with moss. In range 4, there is a large moss swamp interspersed with stretches of tamarack swamp. This range is therefore not suitable for agriculture. In range 3 the soil is much better, and areas suitable for agriculture are found close to the right of way of the Hudson Bay railway, which is crossed by the base line in section 35. McLaren creek which is about one chain wide and ten feet deep traverses this range and empties into Wintering lake. It drains McLaren lake which is three miles long and one-half mile wide.

Range 5 is broken by Halfway creek, a stream about sixty links wide, with a marked current which flows northerly through section 35 and connects with Grass river about four miles farther north. In section 31 a deep bay of Grass river is crossed. The river there appears to be a series of long narrow lakes, connected at the sides instead of the ends by a stream from fifty to one hundred feet wide. Where the stream is thus contracted the current is very swift and falls of from ten to forty-five feet, are not infrequent. The banks are in many places almost perpendicular cliffs, from ten to thirty feet in height. The surface throughout the range is rolling, rising at intervals into rock ridges. The soil on the ridges is rich clay wherever the rock does not outcrop, while in the hollows small muskegs occur. The general slope of the country is to the north, while the ridges run nearly due north and south. In section 33 a marked ridge occurs which is covered with very good spruce from ten to twenty-four inches in diameter. Elsewhere the country is densely timbered with smaller spruce, jackpine, poplar and tamarack.

Range 6 is very similar in its eastern half to the preceding one, while the western portion is more rocky, with more muskeg between the rock ridges. The line crosses another bay of Grass river in section 34. The last two miles of the range is practically all muskeg covered, in places, with water from one to two feet deep. The soil is clay loam on the ridges, but in the swamps this is covered by one or two feet of moss.

In range 7 the rocky ridges seem to continue to the west. Several small lakes could be seen to the south of the base line. The muskeg between the ridges was deeper and wetter than at any time earlier in the season, owing no doubt to the heavy rains and snowstorms in the latter part of September and the early part of October.

The first three ranges of the eighteenth base line west of the principal meridian are gently rolling, with the surface generally dry, and the soil is clay loam suitable for agriculture. A large portion of the country is covered with standing fire-killed timber, consisting of spruce and jackpine. When Sipiwesk lake is approached, however, this gives place to dense spruce, birch, poplar and willow. Throughout the next three ranges the base line crosses channels and bays of Sipiwesk lake. The soil is mostly clay on the islands and the timber is largely very dense small spruce, birch, poplar and jackpine. Across ranges 7 to 12, inclusive, the country is undulating, except where it is broken by the configuration of lakes such as Setting and Goose lakes, and by an occasional rocky ridge. In ranges 13 to 16, inclusive, the country is very broken by the frequent occurrence of rocky ridges which in general follow a northerly and southerly trend.

When the lakes in the district traversed by these two base lines are made accessible by the construction of the Hudson Bay railway, commercial fishing may become an important industry. These lakes, comprising Setting, Sipiwesk, Landing, Wintering, Cross, Paint, Wekusko and Halfway, together with Nelson and Grass rivers, teem with fine whitefish, jackfish and some lake trout, while Sipiwesk lake and Nelson

river have long been famous for sturgeon. As the lakes are comparatively small it will, however, be necessary to guard these fisheries by the proper restrictions in order to avoid depletion of these waters.

Throughout the greater part of the country traversed practically the only merchantable timber to be found is in patches and fringes on the islands and along the lakes and rivers. The larger timber is mostly spruce but smaller spruce, jackpine, poplar and birch suitable for pulp wood is to be found almost everywhere

It is only in recent years that the great clay belt, of which this district forms a part, has been known to exist, and the average citizen to-day still regards this clay area as more or less of a myth. However, the existence of it has been proven beyond all doubt. Although the season of growth may be shorter than farther south, the longer hours of daylight more than compensate for this short season. Experience has shown that most garden vegetables can be grown, as evidenced by the gardens at the two Hudson's Bay company's posts at Nelson House and Cross Lake. The Nelson House post is situated north of the district traversed by the eighteenth and nineteenth base lines while Cross Lake post is south of it. Wheat, oats and barley have been successfully grown, on a small scale, at Cross Lake. The surface of the country is generally rolling and even where only gently undulating, there seems to be sufficient slope to make drainage possible.

It is the hope of those who are interested in the development of this district that minerals of economic value will be found. There is considerable to encourage that hope, as the area traversed by our survey, is crossed by several belts of Huronian rocks. The most important of these are belts at the north end of Wekusko lake and around Wintering lake. Prospectors have been busily engaged around Wintering lake so that now nearly all the land fronting on the lake has been staked as mineral claims. The chief indication is of copper with its allied minerals. Development alone can determine whether or not these claims will prove of any commercial value.

Water-powers in the immediate vicinity of the lines surveyed are to be found on practically all the streams and rivers. The more important ones, however, are those on Nelson and Grass rivers. Those on the Nelson are by far the most important on account of the great volume of water. A table covering the falls on Nelson river compiled from the 1911 report of the Conservation Commission, is given below:—

Name of Rapid.	Approximate Head in feet.	Estimated Horse-power.
Limestone rapid	85	1,140,000
Long Spruce rapid	85	1,140,000
Kettle rapid	96	1,290,000
Gull rapid	67	900,000
Birthday rapid	24	320,000
Grand rapid	20	270,000
Rapids above Sipiwesk lake	31	416,000
Bladder rapid	10.6	147,000
Whitemud rapid	30	403,000
Ebb and Flow rapid	11	148,000
Rapids above Cross lake	45	605,000

These figures are based on a volume of 118,369 cubic feet per second at low water, determined by measurements taken across Nelson river just below Sipiwesk lake. Below the point where these measurements were taken the Nelson is swollen by such rivers as Clearwater, Armstrong, Grass, Burntwood, Kettle and Limestone. These rivers would materially increase the volume and therefore the horsepower of all rapids below Split lake, including Birthday, Gull, Kettle, Long Spruce and Limestone.

No definite data can be found covering the falls on Grass river, but the following is a table showing the approximate height of the falls between Reed and Paint lakes.

Location or Name of Rapid.		Approximate Head in feet.
1st	Rapid below Reed lake.	10
2nd	" " " "	6
3rd	" " " "	48
1st	" " Wekusko lake.	12
2nd	" " " (known as Kanisoto or 2 Rapids)	15
3rd	" " " "	8
4th	" " " (known as White Forest).	
5th	" " " (" " Skunk)	
6th	" " " (" " Whitewood).	40
1st	" " Settling (" " Sasagin)	12
2nd	" " " (" " Pisew or Lynx Falls)	50
3rd	" " " (" " Kwasitchewan Falls)	45

To anyone familiar with river navigation the number of rapids as indicated above suggests very definitely a great many portages. Portages are without a doubt the curse of river transportation. Throughout the season my canoe men crossed over the portages given below, and in several cases some of these portages were travelled a number of times.

Name or Location.	Approximate Length of Portage.
Sea falls on Nelson river.....	150 feet.
Sugar falls on Nelson river.....	300 "
Three small rapids on Nelson river	30 to 50 feet.
Ebb and Flow " "	$\frac{1}{4}$ mile.
Whitemud falls " "	Nearly $\frac{1}{2}$ mile.
Bladder rapid " "	$\frac{1}{4}$ mile.
Over the Hill " "	300 feet.
Red Rock rapid " "	Either 2 portages 50 and 300 feet or $\frac{5}{8}$ mile.
Chain of Rocks " "	100 feet.
Cross Portage from Nelson river to Landing lake....	$1\frac{1}{4}$ mile.
Thicket Portage from Landing lake to Wintering lake.....	$1\frac{1}{4}$ mile.
Portage from Wintering lake to small lake between Wintering and Paint lakes.....	$1\frac{1}{4}$ mile.
Portage from same small lake to Paint lake.	$1\frac{1}{4}$ mile.
Six small portages on Halfway river, each.....	About 100 feet.
Portage to avoid Kwasitchewan falls, Grass river.....	$\frac{1}{4}$ mile.
Portage from Grass river to Halfway lake.....	$1\frac{1}{4}$ mile.
Strawberry portage from Thicket river to Jim creek.....	2 miles.
Portage from Leach lake to Halfway lake.....	3 miles.
Portage from Nelson river to Duck lake.....	1 mile.
Portage from Duck lake to Nelson river below Duck falls.....	300 yards.
Portage past the first rapid above Duck lake	$\frac{1}{2}$ mile.

Of the fur-bearing animals, mink, foxes (red and black, silver and cross), lynx, wolves, weasels, muskrats and beavers are to be found in great numbers. The winter of 1913-14 has been an especially good one for foxes of all shades and colours. Red foxes were taken in great numbers and nearly every trapper had taken at least one or more silver foxes and not a few cross foxes. Black bears, otter and martin although not plentiful are to be found in the district. Moose and the woodland caribou are quite common although not nearly so numerous as in some parts of the country. Some jumping deer were seen in the valley of Grass river. Wild fowl such as geese and ducks are to be found on the lakes and rivers, but not in great numbers. Several varieties of grouse are fairly numerous.

APPENDIX No. 30.

ABSTRACT OF THE REPORT OF A. E. HUNTER, D.L.S.

SURVEYS IN THE RAILWAY BELT, BRITISH COLUMBIA, IN THE VICINITY OF YALE.

I organized my party at Kamloops and proceeding from there located my first camp at Saddle Rock, five miles south of Spuzzum, on May 18, 1913. On the following day the survey of the east boundary of township 8, range 26, west of the sixth meridian, was commenced from the northeast corner of section 1.

The hills along this boundary are very precipitous, and some difficulty was experienced in obtaining men suitable for carrying on the work.

Having completed the survey of the lands adjoining the Canadian Northern railway right of way in this locality, camp was moved five miles north on June 26.

On August 6 camp was again moved across to the right bank of the Fraser, and as the cables and ferry in this vicinity had been carried away by the high water in June, canoes had to be used for crossing.

On September 2 camp was moved to Camp Sixteen, and here the crossing of the Fraser was greatly facilitated by making use of a cable car formerly operated by the Northern Construction company. At Camp Sixteen the Canadian Pacific Railway company has in operation a stone-quarry, and grey granite of excellent quality for building purposes is shipped from that point.

On November 21 I moved to Spuzzum, and on the 24th completed the survey of Spuzzum townsite.

While engaged in this latter work I received instructions to retrace the Canadian Pacific railway through townships 10 and 9, range 26. I completed this retracement on December 3.

I then completed the survey necessary for the disposition of lands adjoining the Canadian Pacific and Canadian Northern railways in township 10, range 26.

The season was then too far advanced to do further work advantageously, so operations were brought to a close on December 15.

The general characteristics of the country along Fraser river in townships 8, 9 and in township 10 as far north as the north boundary of section 14, range 26, are very similar. The hills rise abruptly from the river or from narrow benches along the river, and are cut through by small streams in deep canyons. Level or slightly sloping benches of a few acres in extent are found in places along the river, but the greater part of these arable areas has been set aside as Indian reserves or surveyed into Group Lots.

The soil on these benches is generally a sandy loam with a sand or gravelly sub-soil overlying the solid rock, and although the rainfall in May and June is abundant, the drainage is so rapid that a few hot days in July are sufficient to destroy the vegetation. When properly irrigated, however, the land is very productive and the common vegetables and fruits may be grown to advantage.

Many of the Indian reserves appear to be deserted, the results obtained from cultivation apparently being incommensurate with the outlay for irrigation.

Fir from two to five feet in diameter is found on the benches and creek valleys and in strips on the rocky hillsides, but the timber on the benches has been fairly well culled in the construction of the railways. On the hills, the timber is too difficult of access to be taken out conveniently. Some cedar and hemlock are also found, but not in great quantities.

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Some prospecting has been done for gold in the southeasterly part of township 8, range 25, but although surface indications appeared favourable, no strikes of any importance have been made.

Salmon of many varieties come up the Fraser as far as section 27 in township 9, but the river above this has been so filled up in places by the construction of the railroads as to exclude all but a very small percentage of the fish which have run that far.

Marten, bears, deer, mountain goats, rabbits and partridges are found in the hills adjoining the river.

In the construction of the railroads the wagon roads in these townships have been so cut off as to render wagons practically useless except for short hauls.

APPENDIX No. 31.

ABSTRACT OF A REPORT ON THE SURVEYS PERFORMED BY THE LATE
C. E. JOHNSTON, D.L.S., PREPARED BY HIS ASSISTANT
A. D. STEWART.

STADIA SURVEYS AND INVESTIGATION OF LAKES NORTH AND EAST OF SWIFT CURRENT.

The party left Swift Current the place of organization, on May 30, 1913, to commence work near Ernfold in township 17, range 7, west of the third meridian. From that town, the party worked eastward, and investigated the lakes in a block of about thirty townships in the vicinity of Chaplin.

While traversing Chaplin lake, wooden witness posts were placed at points in fractional sections 3, 4, 8, 9, 16 and 17, of township 17, range 5. It was found that the south half of this lake becomes dry during part of the year so it was not traversed.

While investigating townships 22, ranges 2 and 3, instructions were received to traverse the group of lakes formerly known as Red Deer lakes. Accordingly on October 20 camp was moved to Macrorie, in township 27, range 8, and work was started at Coteau lake, the most southerly of the group on the 23rd. The adjoining townships were investigated, and on November 20, the party moved to township 26, range 11 and examined this township and township 26, range 10.

Camp was then moved back to Macrorie, and later on to Manna and Luck lake, while townships 24 to 26 ranges 7, 8 and 9 were investigated and their lakes traversed. Luck lake was not traversed as it was found to dry up each year.

On December 29, the party returned to Macrorie where the outfit was left and where arrangements were made for wintering the horses; we then moved to Moosejaw where the party was disbanded.

The townships surrounding Chaplin have for the most part good agricultural soil of sandy or clay loam. The surface however in townships 18, ranges 4 and 7 and townships 17 ranges 2 and 3 is to a large extent heavily rolling. In the immediate vicinity of Chaplin lake while the soil is very light, south of the lake the country is very dry and fresh water difficult to obtain. Although the area of this lake has decreased considerably owing to its gradual subsidencé, the greater part will apparently always remain useless, and the remainder will for the most part be suitable only for grazing purposes for some years.

In several townships there seems to be arable land which is still open to settlers. Except just north of Parkbeg and at a few other odd points, the farm buildings are not as large and prosperous looking as those in other parts of the country the one-room shack seems to predominate.

Thunder creek valley which lies about twelve or fifteen miles northeast of Chaplin lake seemed prosperous, with large farms, and good soil. The valley seems to be thickly settled, and there is apparently no open land except school lands or Hudson's Bay Co. property. The buildings are nearly all large and provide generously for livestock and crops.

Around Coteau, Stockwell and Anerley lakes the open land has been nearly all taken up. There is a good deal of what appears to be fine farming land still vacant, but it is held by speculators and the railway companies. The soil is generally sandy to clay loam. The buildings are not all that could be desired but as the land is proved up and the owners' financial positions improve the homesteader's shack is gradually giving way to comfortable homes and larger farm buildings.

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In the neighborhood of Luck lake the soil is sandy or clay loam. The district is well settled, the lake being surrounded by prosperous-looking farms with ample and attractive buildings.

During the past year there seems to have been a general financial depression apparently due to poor crops and the low price of wheat. Oats were grown by some farmers and this crop did not seem to suffer to the same extent as the others. The price given for wheat in the fall months by the local elevators was generally 65 cents a bushel. Twenty-five bushels to the acre was considered a heavy crop for the districts passed through and fifteen to twenty bushels was the average.

Vegetable growing does not seem to be in favour in these parts of the province and the towns have to send away for such as they need. Potatoes were very scarce. One farmer had obtained only three bags where previously he had over one hundred. The price varied from 75 cents a bushel in summer to \$1.50 in winter.

Chicken raising seems to be successfully carried on and turkeys and ducks are also commonly seen. Fresh eggs are generally hard to obtain and sell at from 30 to 40 cents a dozen as a rule.

A prairie fire which originated some distance west, burned out a few settlers in townships 25 and 26, ranges 9 to 11 and caused losses to others of haystacks and pasturage.

Hail destroyed the crops southwest of Dinsmore, but only touched a few sections of township 26, range 11.

The farmers in the district surveyed seem favorably inclined toward mixed farming, and all spoken to were unanimous in saying that it will prove the most paying proposition in the long run.

Despite the poor crops of the past year, the settlers are of the opinion that a good crop this year will prove a panacea for all financial ills.

The lakes and ponds in the districts examined are generally dried up. Ponds and marshes that formerly had some depth of water all the year round are dry now for a good part of the year. In fact in late summer and fall the settlers in some districts have to go quite a distance to obtain water.

Most of the bodies of water investigated had at least traces of alkali, generally too much for domestic use though not enough to prevent its use for stock. Fresh water was found fairly often though non-alkaline stagnant water was seen only a few times.

No signs of minerals, quarryable stone, oil or natural gas were noticed.

In the townships investigated, bituminous coal is the common fuel. The Canadian Northern Railway company is introducing lignite but as yet it is not extensively used.

Lumber is imported into all these townships as there is no bush. Along South Saskatchewan river, there are a few small trees up to two inches in diameter, and the settlers for long distances around haul this brush for kindling purposes. The growth is being rapidly cut down and will probably be gone in a few years if no attempt is made at conservation. There also a few small clumps of bush scattered along the group of lakes which comprises Coteau lake and those lying to the west of it, but the trees are not over two inches in diameter; in fact there are very few approaching that size.

A branch of the Canadian Northern railway between Elrose Junction and Elrose, about forty miles west of Macrorie has been completed and put in operation, and several new towns are springing up along it. The line has also been continued from Macrorie through Elrose Junction to Dunblane, a new settlement in township 26, range 7.

The branch of the Grand Trunk Pacific railway from Moosejaw to Mawer in the Thunder creek valley is also constructed and in operation.

The Canadian Pacific railway line running north from Chaplin through the upper Thunder creek valley in township 20, range 6 has been surveyed, and location stakes of

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various other projected lines were also seen. In the vicinity of Luck lake several lines were run and some were noticed also near Dinsmore.

In Thunder creek valley lines have been surveyed for the Moosejaw water-supply canal.

If this proposition be carried through as projected, it should afford opportunities for the generating of cheap electric power.

Well-graded roads lead north and south from Ernfold on the Canadian Pacific railway, and some good roads run north of Chaplin. A road with the necessary bridges has been built south across Chaplin lake, but it is poor on account of the sandy soil. Another trail leading southeast is poor for the same reason. Three good trails lead out from Ernfold, one to Parkbeg, one to Tugaske and one in a northerly direction. Roads were surveyed during the season west of Chaplin lake and south from Parkbeg through township 17, range 2 into township 16, range 2, where there are now several good roads. North of Thunder creek valley there are generally good roads or trails in all directions. From Tugaske good roads run to South Saskatchewan river, and on the north bank of the latter at Elbow trails lead off in several directions through the sand hills which make hauling very heavy. Around Luck and the group of lakes consisting of Coteau, Stockwell and Anerley, the roads and trails are very fair except in townships 25 and 26 ranges 9 and 10 where there are only poor trails through rolling country.

Exceptionally fine weather prevailed all summer and fall. In the latter part of December it became threatening, and it was decided to close operations on completion of the work then in hand.

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APPENDIX No. 32.

REPORT OF W. J. JOHNSTON, D.L.S.

SUBDIVISION IN THE YALE DISTRICT OF THE RAILWAY BELT, BRITISH COLUMBIA.

CHASE, B.C., July 24, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on my work for the season of 1913.

I left Vancouver for Hope, in township 5, range 26, west of the sixth meridian, on May 12, 1913, via the Canadian Pacific railway, and established my first camp on the north side of Fraser river, near Hope station. There I completed what subdivision was possible, traversed a few miles of the right bank of the Fraser and retraced the boundaries of a few Indian reserves. On May 30 I moved my camp across the river and began subdivision there. The boundaries of a few Indian reserves were retraced and provincial lot No. 873 was surveyed. The left bank of the Fraser in section 34 and an inland at the mouth of Silver creek were traversed, and the points of intersection of all surveyed section lines with the Canadian Pacific and Canadian Northern railway lines were determined. These railways run almost parallel on opposite sides of the Fraser.

From this camp I also subdivided part of township 6, range 26, on the east side of the Fraser, and traversed the left bank of the river. For transport we used a hand car on the Canadian Northern railway track, which was laid and ballasted at that time.

On July 26 I moved my camp by wagon to Choate siding over the old Yale-Cariboo road, which is gradually getting into bad shape through neglect. There I commenced subdivision on the west side of the Fraser in township 6, range 26. The boundaries of the Indian reserves and provincial lots were retraced, and Strawberry island and a portion of the right bank of the Fraser were traversed. The points of intersection of all surveyed section lines with the Canadian Pacific railway were determined.

On August 21 we moved to Yale over the Yale-Cariboo road. From this camp I subdivided lands on both sides of the Fraser, in township 7, range 26, and traversed both banks of the river through the Yale canyon. I used a hand car over the Canadian Pacific and Canadian Northern railways for transport. The work in this township was rather difficult and slow, owing to the rugged nature of the country.

The valley through townships 5, 6 and 7, range 26, averages about a mile in width, though in many places the mountains run down to the water's edge. The land is covered with scattered fir, cedar, and spruce up to three feet in diameter, with a heavy undergrowth. The soil is a sandy loam with a gravel subsoil. The best land is taken up by Indian reserves and provincial lots, and in most cases no development has been made on them. Irrigation farming is being undertaken on lot 65, group 1, and it is proving a success. Fishing is good in the mountain streams, mountain trout being very plentiful, though small. There was a large run of salmon in the Fraser during the months of July, August, and September. Game was rather scarce, though deer are more plentiful in the fall, when they are driven down by the snow.

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No water-powers were seen. Mosquitoes are very scarce, owing to the streams being so cold and swift. There was a heavy rainfall during the summer months, chiefly at night.

On October 6 I moved my camp via the Canadian Pacific railway to Hope, from where I retraced two miles of Indian reserve boundaries on Yale Indian reserves Nos. 13 and 14. While there we experienced almost two weeks of steady rain.

On October 16 we moved by wagon to St. Elmo over the Yale-Westminster road, which is in good condition. From this camp I ran a few miles of subdivision in townships 4, ranges 27 and 28 and traversed some islands in the Fraser. The soil is a sandy loam, and is very rich. The valley on the left of the Fraser extends back about a mile and is covered with timber, chiefly of second growth. Mixed farming is followed and there is an abundance of fruit.

On November 3 we moved to Pitt river over the Canadian Pacific railway and by launch up Pitt river to Pitt lake in township 4, range 5, west of the seventh meridian. There I surveyed timber berth No. 559. This berth is at an elevation of 3,000 or 4,000 feet and is very rough in places. Some fine cedar, fir and hemlock, up to four feet in diameter, were seen. Owing to a two-foot fall of snow I had to abandon the work before completion and return to Ruby creek where I arrived on November 28.

There we began subdivision in township 4, range 28 and township 5, range 27, west of the sixth meridian on the right bank of the Fraser. In township 4, range 28, the land was rough and mountainous to the river's edge. The right bank of the Fraser was traversed.

Only a few miles of subdivision were run in township 5, range 27. There is very little farming being done there yet, but some good land was subdivided. The soil is a sandy loam with a gravel subsoil.

On December 20 I disbanded my party and returned to Vancouver.

I have the honour to be, Sir,

Your obedient servant,

W. J. JOHNSTON, D.L.S.

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APPENDIX No. 33.

REPORT OF G. J. LONERGAN, D.L.S.

INSPECTION OF CONTRACTS IN ALBERTA AND NORTHERN MANITOBA.

BUCKINGHAM, QUE., February 21, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Can.

SIR,—I have the honour to submit the following general report on my last season's operations.

My first work was the inspection of contracts Nos. 14 and 15 of 1912, comprising the townships through which Carrot river flows in ranges 7, 8, 9 and 10 west of the second meridian. From Tisdale we followed a well-graded road almost due north to Arborfield passing through a well-settled district where mixed farming is successfully followed. From Arborfield the only trail running to the northeast is the one made by the surveyors. It passes through a country that was at one time heavily timbered but fires destroyed the timber about fifteen years ago, and there is now a second growth of poplar and willow, scarcely exceeding four inches in diameter, with considerable windfall in places. The soil is chiefly a loam from three to five inches in depth with a clay subsoil and the surface is almost level. There is ample drainage provided by small creeks, the valleys of which seldom exceed six feet in depth. They flow northerly emptying into Carrot river which is not navigable at this point. In low water it can be forded at almost any place. After completing the inspection I returned to Edmonton.

My next work was the inspection of the mounds in contracts No. 35 and 36 of 1912. These contracts are situated northeast of Holmes' Crossing along Athabaska river. Knowing that the trail from Belvedere west would be in a very bad condition and that there was no horse feed in the country I decided that the cheapest and quickest way to get there was to go west on the Grand Trunk Pacific railway to Hinton and then paddle down the Athabaska in canoes. The upper part of the Athabaska is not navigable for steamboats and in low water there is just sufficient for canoes drawing twelve inches of water. The current is very swift and there are many small rapids. The first one hundred and twenty-five miles can be covered in two days, after that thirty to forty miles per day is fair travelling, much depending on the wind and the height of the water. At Holmes' Crossing I engaged teams to take the camp outfit to contract No. 36 and on the following day we started the inspection of the mounds. When this was completed we returned to the Crossing, and going down stream we inspected contract No. 35 from the river. Northwest of Holmes' Crossing along the Assiniboine flats there is a large settlement of people from Dakota. They have but recently gone in there and their progress is somewhat slow as there is but little open country. However, they report that they are not troubled with frost and everything they have tried so far has been successful, particularly garden vegetables; the small patches of grain that they put in have ripened thoroughly. A railway location was surveyed in the winter of 1911 crossing the Athabaska at Holmes' Crossing and heading for Sawridge. From what I could find out it runs parallel to the Calgary and Edmonton railway and about fifty miles west of it. Although I could get no information concerning the road the fact that a survey has been made is a start, and such a good country cannot remain much longer without railway facilities. Having com-

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pleted the inspection I continued down the Athabaska in canoes to Athabaska settlement then by train to Edmonton.

In connection with this trip I would like to mention that there is one place west of where the Athabaska crosses the trail to Grande Prairie that is a remarkably good site for power development. The river turns at right angles and enters a narrow gorge about two hundred feet deep and from three hundred to four hundred feet wide; the banks and bottom are sandstone. A dam could be built across and the water held back forming an immense reservoir insuring a uniform supply during the whole year. Gravel for the dam could be had a short distance back from the proposed site. There is no doubt this is a national asset that is worth while looking into and preserving.

My next work was to extend the lots of Lesser Slave Lake settlement to the shore of the lake. Owing to the extremely low water, navigation was late in starting and the large accumulation of freight made it impossible to secure accommodation on the steamboats, so I started overland with my horses and wagons. The road is so bad that it does not pay to travel it after the frost is out, particularly with any kind of a load.

There is a lot of good country yet to be taken up along the south side of Lesser Slave lake in the vicinity of Swan river and west of it. It is equal to the Peace river valley and has the advantage of being close to navigation and to a railway that is almost constructed at this date. An abundant supply of hay can be cut and there is ample rainfall in this district.

My next work was a settlement survey at Wabiskaw lake. There are three routes to reach this place. The first is a winter trail from Athabaska direct to Wabiskaw which follows the frozen lakes and marshes and is impassable in summer. The second goes down the Athabaska to Pelican river, and up that river. By this route I am told there are fourteen portages varying in length from a few hundred yards to three miles, and some of the portages are over muskegs and swamps which are not practical for heavy loads. However all the spring catch of fur that is taken after the roads break up is taken out this way. The fur-dealers of Wabiskaw have their goods brought down to the mouth of Pelican river during summer and stored, then freighted to Wabiskaw by teams during the winter. The third route, which was the one I chose, is a pack trail from the mouth of Martin river on Lesser Slave lake. While waiting for my pack saddles to arrive from Edmonton I started my men opening up this pack-trail into a wagon road. In this way we were able to use wagons for about thirty miles and pack-horses for the remainder of the distance. As I had but eight horses to pack for twelve men I cut the outfit down to one blanket to each man with what clothes he was wearing, using only one tent for the party and taking provisions for ten days. This with the iron posts, instruments and other necessary articles made a maximum load for the horses.

Wabiskaw is situated on the north side of a channel joining two lakes. This channel flows through a marsh which varies in width from one to two miles. When I arrived at the south side of this marsh, which at that time was covered with water from four to six feet deep, I had considerable difficulty in attracting attention but I finally got an Indian who was hunting ducks to take me across in his canoe. I then rented boats to take the men and outfit over and swam the horses, nearly drowning one of them. On the following day, we started work.

The settlers at Wabiskaw are mostly half-breeds and Indians with white people in charge of the three stores and the missions. The total amount of land under cultivation is about seventy-five acres while the total length of wagon road is less than a mile. Upon inquiring into the cause of this backward condition, the fur dealers told me that successful hunters made as much as two thousand five hundred dollars during the season with furs, and that it did not pay them to cultivate land. Labour is worth two and a half dollars and board per day; but two to four days' was as long as any person would work at one time; they would then take a holiday. Goods are sold at from five to six hundred per cent higher than in Edmonton. There are three trading posts.

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Church of England and Roman Catholic missions and a monthly service mail from Sawridge by packhorses.

Wabiskaw is located in the centre of an immense saucer-shaped tract of land, and during a wet season all the water drains down into the lake, and as there is but one small outlet the water rises and floods the hay marshes, and does not go down again until November, when it is too late to cut hay. This could be easily remedied as the outlet of the lake is Wabiskaw river, and half a mile from the lake the river is a succession of rapids; all that is necessary is to widen the channel, not to deepen it. By this means the overflow of water would run out, and the depth of the lake would be maintained, thus protecting the fishing industry. This industry is not followed at present, not for lack of fish, but because the freight rates are prohibitive. Such a conditions of affairs will not last for more than a couple of years as a direct communication will then be opened up with the Edmonton and Dunvegan railway at Sawridge.

The land in this vicinity is covered with scrub and scattered poplar from four to eight inches in diameter with a few spruce in places. I saw no timber fit for milling purposes, but was told that there is a sufficient supply for future settlers, though not enough to warrant the erection of a large saw-mill. The only means of cutting it at present is the slow process of whip-sawing. When the land is cleared it will be as productive as any other part of the province. The Roman Catholic mission people are at present raising oats, barley, wheat and all kinds of garden vegetables, all of which ripen. The soil is a clay loam. The first twenty miles along the trail from Wabiskaw to the mouth of Martin river has been burned over, and a farmer could start easily, more particularly if he had a few head of stock. Good water may be had in abundance everywhere.

The survey being completed, I started on my return journey. I swam my horses across the marsh a little west of the mission, then struck south about three miles, again swimming Willow river and heading in a westerly direction through the bush until I reached the trail by which I came in, and finally arrived at the mouth of Martin river on Lesser Slave lake. At this place I started the inspection of contracts Nos. 5 and 9 of 1913. We soon ran out of provisions, however, and had to move to Sawridge. On my arrival there I found that the supplies I had left in the Northern Transportation company's warehouse had been destroyed by the unusual and extreme high water. As it was impossible to purchase supplies there, and as there were three contracts to be inspected along Athabasca river, I left my transport at Sawridge and went to Edmonton by boat and train. I purchased supplies and went by train to Hinton, where I started on a second trip down the Athabaska in canoes. I inspected the three contracts along that river, and followed the river down as far as Mirror Landing, then moved up Lesser Slave river and thence to the west end of Lesser Slave lake, and commenced working eastward. I made use of the canoes on this trip as I knew the high water had flooded the trail around the lake, and that the railway grade which crosses the trail so often would make it almost impossible to use wagons. This trip was successfully made in canoes and the work was completed.

I arrived at Mirror Landing on November 1 to find the Athabaska full of running ice. I found out by telegraph that it was impossible to cross on the ferry at Athabaska, and as the railway company had a scow working at Mirror Landing I made arrangements with them to cross my outfit. This we did by putting one team in the scow at a time and tracking it up half a mile along the shore and then working it across with poles while drifting down. I drove to Edmonton along the new Edmonton and Dunvegan railway line, and on my arrival stored the outfit, placed my horses in winter quarters, and paid off my party.

I have the honour to be, Sir,

Your obedient servant,

G. J. LONERGAN, D.L.S.

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APPENDIX No. 34.

REPORT OF E. S. MARTINDALE, D.L.S.,

BASE LINE SURVEYS IN EASTERN SASKATCHEWAN.

AYLMER, Ont., July 31, 1914.

E. DEWILLÉ, ESQ., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report on my survey operations during the season of 1913-14.

Instructions for the survey of the sixteenth base line from the third meridian to the second were received early in February, 1913. I left for Prince Albert immediately, in order to have the season's supplies cached at suitable places before the winter broke up, and also that I might be able to run the base line across Montreal lake on the ice, thereby avoiding the long and difficult triangulation which would be necessary in the summer. It was found upon making inquiry, that a proposed railway, known as the Hudson's Bay Pacific railway, now abandoned, had been surveyed northeasterly from Prince Albert for a distance of over one hundred and thirty miles. This line crossed the fifteenth base line in range 18, and from there was reported to run almost due north. I arranged to have a cache established in the vicinity of the sixteenth base line on this railway line by making use of the road cut out at the time of the survey, for freighting in the supplies. My assistant took charge of this work but, because of the excessive depth of snow and the lateness of the season, he succeeded in reaching a point only about two miles north of the fifteenth base line, where the supplies were cached. In the meantime I had organized a small party, and, with a hired transport outfit, left for Montreal lake to carry out the other part of the work which it was advisable to complete before the break up. After arriving at Montreal lake, a trail was cut westward nearly to the meridian, and the survey of the base line was commenced. The snow at this season was very deep and retarded progress to some extent. The line was run to the east side of Montreal lake, a distance of about fourteen miles, by April 5. A cache was built there, and the supplies which had been forwarded by the Hudson's Bay company from Prince Albert to their post at the south end of the lake, were then freighted up the lake and stored; this work was completed by April 9. By that time the snow had practically all disappeared, and travelling with our sleighs was very heavy. Prince Albert was reached on the 13th, and the party paid off the following day. I then proceeded to Ottawa for observing practice, and while there completed my final returns for surveys of 1912.

In the meantime I had been instructed to complete the fifteenth base line by running east from the third meridian to the east boundary of range 22, before again taking up work on the sixteenth base line.

On June 7, 1913, I again left for the West. Horses and transport outfit were collected from Edmonton and Lac la Biche, Alberta, and from Bowsman, Manitoba, and shipped to Prince Albert where the party was organized. On the 26th, the outfit was sent out with teams in charge of the assistant to the "Red Deer Forks" on the Montreal lake road, near our point of commencement, and a pack trail was cut to the third meridian. By June 24 our horses had all arrived at Prince Albert and on the

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following day I left there with the packers, reaching camp July 3. We moved to the meridian and commenced survey work the next day. Four days of almost continuous rain beginning on the 10th flooded the country and made the swamps and muskegs almost impassable for horses.

Our work on the fifteenth base line was completed on September 25. A trail was then opened out from the west side of Candle lake northerly to a lake on the northerly boundary of township 58, range 23, then westerly to the east shore of Montreal lake and thence north along the lake shore to the sixteenth base line where work had been discontinued in the spring. The survey of this base line was then carried on to its completion at the second meridian, the final closing being made on June 20, 1914.

Horse feed along the base line was very scarce and of poor quality, and, after freeze up, hay and oats had to be freighted in from Prince Albert by way of Hudson Bay Pacific trail. Our inability to get in touch with this trail until December, and the failure of freighters to get through with horse feed, caused us to lose considerable valuable time in December and the beginning of January. Practically no snow fell to the south of the fifteenth base line until late in January, and it was difficult to get freighters to venture on long trips with wagons at that time of the year.

Horse toboggans or flat sleighs were used for transportation during the winter months and also in the spring until the frost was practically all out of the muskegs, and they proved most satisfactory for the purpose. Our sleighs were two feet wide, twelve feet long, made of one and a half inch oak and were fitted with shafts. Loads of from five to ten hundred pounds were hauled, depending on the state of the trail and three men had no difficulty in handling the outfit of eight sleighs. In the spring after the snow was gone, the ponies hauled from three to four hundred pounds. Extra heavy canvas should be used for covers in this work and special attention should be given to the lashing of the loads in order to prevent damage to camp outfit and loss of supplies.

The intersection of the sixteenth base line and the second meridian falls in Namew lake and it was necessary to make the closing on the meridian at the northeast corner of section 25, township 60.

The survey being completed, the outfit was loaded on a barge and taken by steamer down through Namew and Cumberland lakes and Saskatchewan river to Pas, where it was shipped via Canadian Northern railway to Prince Albert, reaching there on June 23. The men were paid off, the outfit stored and arrangements were made to pasture the horses for the summer.

Routes.

There are two main transportation routes into that portion of the north country lying between the second and third meridians, one following more or less closely each meridian. At the west the Montreal lake road runs northerly from Prince Albert past Shoal Creek headquarters camp of the Prince Albert Lumber company, situated a little north of the fourteenth base line and west of the meridian, and then crosses the fifteenth base in range 1 and the meridian in township 57, thence northeasterly to the small settlement at the south end of Montreal lake. The winter trail then runs north, crossing Montreal lake, to lac La Ronge. From Prince Albert to the Shoal Creek camp the road is in fair condition nearly all year, but north of this it passes through many swamps and muskegs and in consequence used but little in summer. In the winter, however, a large number of teams are employed in freighting the yearly supply of provisions and merchandise for the various trading companies located at Montreal lake, lac La Ronge and Fort Stanley.

Along the second meridian a sleigh road, following rivers and lakes for the most part, runs from Pas to Cumberland House, thence northerly across Cumberland, Amisk and other lakes to Pelican narrows on Pelican lake, from which place the northern freight is distributed by water route in the summer. This road which crosses the

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sixteenth base line in range 2 was opened out from Cumberland lake north in the winter of 1912. In the summer this country can best be reached by water from Pas up Saskatchewan river to Cumberland lake and through Whitey and English narrows to Namew lake. Numerous steamers and gasoline launches are now operating on this route catering to the needs of the prospectors going into the recently-discovered gold fields of Amisk lake, which are reached from Namew lake by means of a newly-cut portage (wagon road) fourteen or sixteen miles in length.

The Hudson Bay Pacific railway trail runs northeasterly from Prince Albert crossing the fourteenth base line in range 21, the fifteenth in range 18 and the sixteenth in range 16. The end of this trail is reported to be about fifteen miles northeasterly from its crossing on the sixteenth base line. This road has practically never been used, except by a few trappers, since it was first cut. Summer travel is difficult on account of swamps and muskegs, while between the fifteenth and sixteenth base lines it follows rough broken and hilly country making winter travelling also heavy. It is joined a few miles north of Torch river by a road from Fort à la Corne.

Another wagon road runs northerly and easterly from Prince Albert to the south end of Torch lake. By this route the country in the vicinity of the fifteenth base line in range 23 may be reached but in summer it is necessary to complete the trip from Torch lake to the base line by water.

Description of the country adjacent to the fifteenth base-line from range 27 to range 22 west of the second meridian.

From the third meridian to Bittern lake in range 26 the country varies from rolling hills, covered with small birch, poplar and spruce in the western part of range 27, to low level swamp and muskeg with low jackpine ridges. To the north of the base line, tamarack, swamps and muskegs extend nearly to Montreal lake, while to the south it is more rolling with a few small areas of good spruce. To the south of the base line in range 27 drainage is to the southwest through Spruce river and emptying into the Saskatchewan at Prince Albert, while the water to the north flows through Bittern river and finally into the Churchill. Bittern lake is a long, deep, narrow body of water about twelve square miles in extent, which overflows through Bittern river. It is reported to be well stocked with whitefish and pike. Several small streams flow into the lake, namely, Bittern creek from the west, Wolftrap creek from the south and McLean creek from the east and south. A small tract of good milling spruce is found at the south end of the lake. Bittern river, from one to two chains in width, follows a tortuous route from Bittern lake to the south end of Montreal lake and is not navigable by canoe throughout its whole length because of numerous small shallow rapids. A wagon road has been cut between the two lakes and is used by the Indians from Montreal lake who fish at Bittern lake in the winter. An Indian reserve has been set apart at the south end of Montreal lake; this includes several hundred acres of very good spruce and poplar running from ten to twenty inches in diameter. Located there are the trading posts of the Hudson Bay company, Révillon Frères, and one or two other independent traders, also a small mission day school for the Indian children.

Range 25 is low and wet with the exception of a low poplar ridge crossing the base line and extending for a distance of about three miles on either side of the line. McLean creek, about eight feet in width and from three to six feet in depth, was crossed in section 31 in an open swamp. To the south of the line the country appears to be higher and more rolling and is mostly covered with small jackpine, while to the north it is fairly level consisting of spruce muskegs separated by low jackpine ridges; there are also some large areas of very thick small spruce. Clearsand lake, or as it is sometimes called "West Candle lake", covers an area of about eight square miles and drains to the east into Candle lake. Range 24 is higher and more rolling; it is mostly covered with birch and poplar from three to eight inches in diameter and also

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some jackpine up to nine inches in diameter. There is also an area of about one hundred acres, thickly covered with spruce and poplar up to twenty-four inches in diameter, a short distance south of the base line in this range. To the south are jackpine ridges with spruce muskegs and tamarack swamps.

Candle lake was crossed near the north end in range 23. This is a fine body of water covering an area of sixty or seventy square miles. Whitefish and pike are caught but not to the same extent as was the case a few years ago. Torch lake, to the south and west of, and in close proximity to Candle lake, covers eight or ten square miles and drains into the latter through Fisher creek, a deep narrow stream about three miles in length. This lake is surrounded to the northwest and northeast by large hay meadows which, however, are subject to flooding in wet seasons. A considerable area of good milling spruce lies to the south of the northwest portion of Candle lake which, I understand, has already been disposed of as a timber berth. Torch river flows from Torch lake through the southeast arm of Candle lake into Saskatchewan river near Cumberland lake. To the north and east of Candle lake the country rises about 190 feet in crossing range 22. There spruce muskegs alternate with low jackpine ridges. Along the east shore of the lake is a narrow strip of poplar and spruce up to eight inches in diameter.

The soil on the ridges and on the higher ground is a sandy loam throughout, while on the lower lands it is a vegetable muck. There is some good agricultural land in the vicinity of Candle lake and at a few points along the base line, but at present, this country generally, is too wet to be of much value for agricultural purposes.

A farm has been taken up at the mouth of Fisher creek on Candle lake where vegetables such as potatoes and turnips are successfully grown.

Description of the country adjacent to the sixteenth base line, from the third to the second meridian.

At the point of commencement of the base line at the third meridian is a tract of good milling spruce from eight to twenty inches in diameter, extending to the east a distance of thirty chains to a branch of Burntwood river. The greater portion of this area appears to lie to the west of the meridian. East to Montreal lake the country is rolling with a descent of approximately one hundred feet in the seven miles from the meridian to the water in the lake. For the most part it is wet and swampy with occasional poplar and jackpine ridges. The western shore of the lake is low, mostly spruce and tamarack muskegs. To the north and west of the base line the land appears to be higher and more rolling. The soil is a vegetable mould varying from two to six inches in depth, underlaid by a sandy subsoil. Burntwood river, which is about a chain in width, is crossed in section 33, range 27, and flows south between steep banks to its junction with Crean creek, thence easterly to Montreal lake. A few small lakes were noticed in this district.

Montreal lake, nearly seven miles in width where it is crossed by the base line, has a length of over thirty-two miles and an area of nearly one hundred and seventy square miles, and is comparatively shallow. Fish are not plentiful and are of poor quality. To the east of Montreal lake the country rises six hundred feet or more to the height of land between the Churchill and the Saskatchewan near the west boundary of range 18.

The east shore of the lake is also swampy to a large extent. There are a few patches of good spruce to the south of the base line not far from the lake. Farther south are also a few small hay meadows. A lake about two miles in extent, is situated in township 59, range 23, and is well stocked with whitefish; to the west of the lake are several hay meadows where hay is put up by the Montreal Lake Indians. There is also some good agricultural land in this vicinity, the surface being rolling and wooded with small poplar and spruce.

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In range 24 a strip of good timber two miles wide, and with an area of about ten square miles, was crossed by the base line. The trees which are mostly spruce, jackpine and poplar, are from eight to twenty inches in diameter and are clean and straight. In ranges 23 and 22 the land is gently rolling, mostly spruce and tamarack muskegs with occasional clumps of small spruce and poplar and low jackpine ridges. An open swamp one and a half miles wide from ten to twelve miles long was crossed in range 23.

In range 21 the country both to the north and south of the line becomes more broken. To the north the surface is broken by deep ravines, and is wooded mostly with small poplar, spruce, birch and jackpine, while to the south are spruce muskegs and jackpine ridges, the latter becoming more prominent and numerous. A series of three large lakes known as the "White Swan" lakes lie to the south of the line in this range. Drainage from these lakes is to the southwest into the lake in township 59, range 23, and thence to Candle lake. The height of land there is but a short distance south of the line and runs approximately east and west. Ranges 20, 19, 18, 17 and part of 16 are from rolling to hilly, being broken by deep ravines running nearly at right angles to the base line, and are covered, generally speaking, with a thick growth of small spruce and jackpine with occasional small areas of birch and poplar four or eight inches in diameter. A few small patches of good spruce were also noticed in these ranges. To the south near the correction line is a well-defined range of sand hills running nearly east and west. It is reported that this broken country extends northwesterly to Pipestone lake, a large body of water lying a short distance southeast of lac la Ronge. To the south of the line in ranges 18 and 17 the country has been burned over within recent years. There are numerous small lakes along this part of the line.

From the height of land an elevation of 2,242 feet above sea-level, the country drops rapidly to the east to the large muskegs at the east of range 16 with an elevation of 1,434 feet. The Hudson Bay Pacific railway survey, crossed in section 36, range 16, marks the easterly limit of the higher hilly country. In range 16 there is some poplar and birch averaging eight or ten inches in diameter; the surface both to the southwest and northeast is wooded with jackpine from four to eight inches in diameter.

From Montreal lake to range 16 the soil consists of a layer of vegetable mould underlaid by a loose sandy subsoil except in the hilly country and on the ridges, where it is inclined to be heavier and stony.

From range 16 to range 2 the nature of the country is practically uniform, the greater part being low, apparently level, and wet, with tamarack swamps, spruce muskegs, quaking bogs, occasional low jackpine knolls and ridges and patches of small spruce. The south branch of Mossy river was crossed in range 15. It has an average width of forty feet and joins the main stream some distance farther east. Along the banks of this river are a few large spruce trees. This river which is the main drainage outlet of the district, was crossed at three points on the line, first in range 13 and twice in range 11; it has a width of from two to three chains and on account of numerous small rapids is difficult for navigation even with canoe. Brougham creek, from thirty to fifty feet wide and flowing south to Mossy river was crossed in range 7. To the east of this creek in the same range is another small area of spruce and jackpine of eight to twelve inches in diameter. Lakes in this stretch of country are few in number and are small and marshy. From a point about half a mile south of the second crossing of Mossy river in range 11, an old flat-sleigh trail runs easterly to "Pine bluff" which lies about nine miles up Muskeg river from Cumberland lake. A winter dog trail from "Pine bluff" running north, crosses the line in range 6.

A small Indian reserve has been laid off at "Pine bluff," and outposts of the Hudson's Bay company and Revillon Freres are located there.

A lake in township 62, range 6, is reported to be large and deep and well stocked with fish. Grassberry river was crossed in range 5. This stream varies from one to

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two hundred feet in width and is six feet deep, except at the numerous small rapids where the shallow water makes canoe travel difficult and tedious. It flows south-westerly from a lake about ten miles north of the base line joining Mossy river at "Pine bluff." These waters flow into one of the several channels of the Saskatchewan leading to Cumberland lake.

An old sleigh trail, cut from Cumberland lake to the lake in township 62, range 6, as a means of freighting fish from the latter to Cumberland House many years ago, was crossed in a large quaking bog in range 4. Mackenzie lake, in ranges 4 and 3 south of the line, has an area of about twelve square miles and is almost entirely surrounded by muskegs. It drains into Cumberland lake through a small creek at the southwest corner. According to all reports, it is well stocked with jackfish.

In range 3, along the base line and to the north of it the proportion of dry land to muskeg begins to increase. The surface is gently rolling, and the limestone ridges first noticed in range 6 become more prominent. From the base line south to Cumberland lake there is practically no dry land except near the lake shore. The winter portage from Cumberland lake to Amisk lake is crossed in section 32 range 2. From the base line to Cumberland warehouse on the north shore of the lake, the road runs almost continuously through quaking bogs. Near the lake are some well-defined ridges made up of limestone and granite boulders, evidently carried there and deposited by the ice.

Across ranges 2 and 1 east of O'Leary lake the country is fairly level and dry, being partly covered with jackpine from six to ten inches in diameter. There is also some dry spruce muskeg with tamarack swamps both to the north and south of the line. Several lakes with areas of about five square miles lie in these two ranges and are well stocked with jackfish. The base line closes on the second meridian in Namew lake, a large body of deep water with rocky (limestone) shores. Excellent whitefish and jackfish are caught, and sturgeon fishing was an important industry on this lake a few years ago.

The soil in ranges 1 and 2 is a clay loam which to all appearances is well suited for farming. From range 16 to range 2, however, the soil is mostly a vegetable muck which, if drained and exposed to the sun, would no doubt in time become valuable for agricultural purposes. No hay meadows whatever were seen in the immediate vicinity of the base line throughout its whole length.

No traces of economic minerals were seen. Large game, such as moose, deer and caribou, are plentiful, while elk are frequently seen in the neighbourhood of Torch lake. Bears and the other important fur-bearing animals such as lynx, mink and foxes are frequently seen. Timber wolves were also heard during the winter. Rabbits were unusually plentiful during the winter of 1913-14, but they are commencing to die off. Spruce and birch partridges are common in some localities, and occasional prairie-chickens and ptarmigan were also seen. Wild fowl such as ducks and geese were very scarce at the western end of the line, but were plentiful in the swamps nearer the second meridian.

The summer of 1913 was unusually wet. The winter following was mild, except for a few cold snaps of short duration; snow was not as deep as usual, being about two feet on the level, and it did not come until late in the season. Summer frosts are frequent, as is the case in all the newer parts of the Canadian West, but otherwise the climate is very much the same as it is farther south on the prairies.

I have the honour to be, Sir,

Your obedient servant,

E. S. MARTINDALE, D.L.S.

APPENDIX No. 35.

ABSTRACT OF THE REPORT OF H. MATHESON, D.L.S.

SURVEYS IN THE VICINITY OF JASPER, ALBERTA.

On May 21, 1913, I left Edmonton, Alberta, for Jasper, where I arrived on the morning of the following day. After examining the country and consulting Col. Rogers, Superintendent of Jasper park. I commenced a survey of the townsite on May 23.

At that time the town consisted of only a few scattered shacks situated in the vicinity of the railway station. It was a typical railway construction town. The only permanent buildings were those belonging to the Grand Trunk Pacific Railway company consisting of a station, roundhouse, and some smaller buildings.

These buildings were situated on a flat about half a mile wide and about two miles long, lying along the left or west bank of Athabaska river just below its junction with the Miette. This flat is fairly level and is about sixty feet above the level of the Athabaska river bed. It is bounded on the north and west by a hill which is from two hundred to three hundred feet high and which rises to a rolling plateau broken by small creeks and numerous small lakes. The largest of these lakes are Cabin, Pyramid and Patricia lakes. Cabin creek drains Cabin lake, and runs across Jasper flats; it is used as a source of water supply for the town.

Practically the whole of Jasper flats consists of boulders and gravel. Consequently it has good natural drainage. It is a very suitable location for a townsite, even though excavation for sewerage and waterworks systems is difficult on account of the great number of boulders. Excavation for building foundations is also difficult, but the boulders obtained in the excavation can be used for building purposes, and when properly used greatly enhance the architectural beauty of the buildings. My surveys were considerably retarded by the boulders, as a hole had to be made for every iron post planted to mark the townsite. I do not think that any post could have been driven to its proper depth without striking a boulder.

Jasper flats, except the parts cleared for townsite purposes, are covered with timber consisting mostly of small jackpine and a few large Douglas fir. The fir, on account of their thick bark, have been able to withstand the forest fires which have occasionally swept the country, destroying all the other timber. On the rolling plateau west and north of Jasper there is much *brulé* and dead standing timber, mostly spruce and pine up to two feet in diameter. Some of this is also found on Jasper flats. The Douglas fir is not found much farther east than Jasper, but live specimens as large as four feet in diameter are found in that vicinity. On account of forest fires, very little large green timber of any other variety is found except where it is protected in deep gullies.

The townsite is situated west of the Grand Trunk Pacific railway, adjacent and parallel to the right of way. The railway depot is opposite the centre of the townsite. The avenues are parallel to the railway track and the streets approximately perpendicular to it. It consists of twelve blocks and ten reserves.

I completed my survey of Jasper townsite on June 27, and then moved my outfit into the Brazeau district to complete some work which I had started in 1912. The work to be done lay in townships 47 and 48, ranges 17 and 18, west of the fifth meridian. A Canadian Northern railway location line runs through the district. I surveyed sufficient section lines to tie in the right of way in these townships.

To reach this work I proceeded by train from Jasper to Bickerdike, and thence by the Alberta Coal branch to the Pacific Pass Coal mines (now called "Lovett"). From the mines I travelled northeast for three days by pack train to my first work in township 48, range 17.

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The townships surveyed consist mostly of wide low ridges separated by shallow muskeg. They are thickly timbered with spruce, jackpine and some poplar and willow. Tamarack is found in the muskegs. Most of the large timber has been ruined by fire, and now lies as *brulé*. The difficulty of travelling over this fallen timber was the greatest handicap to the work. The soil is generally a sandy loam with few boulders, and would be very productive if it were cleared, and the muskegs drained. However the general elevation of the district is high, so that it is subject to summer frosts, and it will not likely be used for agricultural purposes for some time. I completed my work in this district on September 9 and then moved my whole outfit back to Jasper.

I found conditions at Jasper considerably changed. Many of the houses were moved on lots in the townsite. Considerable progress had been made in grading the streets and a new administration building was about half completed. This is a handsome building constructed of boulders. A road was also built to Pyramid and Patricia lakes.

My first duty was to traverse the road to the lakes and then to lay out villa lots one hundred feet by one hundred and fifty feet, around the lakes. Pyramid lake is somewhat crescent shaped, and has an area of about three hundred acres. It is drained from the north end by a creek. A number of small creeks run into it through a muskeg on the south side. The southern and eastern shores of the lake consist of muskeg flats and benches up to ten feet in height. On the north and west sides fairly high steep hills rise from the water's edge. There is a small well wooded island in the lake, which is very beautiful. Patricia lake is long, narrow and fairly straight, and has an area of about one hundred and twenty acres; the average width is about nine hundred feet. It has no visible outlet or inlet, and its water has a bitter taste. In some parts steep hills rise from the water's edge, while in other parts of the shore there are benches not more than twenty or thirty feet above the level of the lake.

These lakes will make very fine summer resorts as they are suitable for boating. There is a good choice of lots; they can be had on low benches, high benches or on hillsides of various slopes. The front and back lines of the lots are curves and tangents parallel to the lake shores. Patricia lake is approximately three and a half miles and Pyramid lake four miles from Jasper. The new road from Jasper has an easy grade and is suitable for automobiles.

I completed my survey of villa lots on October 21. I then surveyed four corrals of about one acre each, and one of about two acres, situated behind Jasper townsite near the foot of the hill. The small corrals are to be leased to packers who furnish transportation and act as guides to tourists. The large corral is for the government transportation outfit. The corrals form block "A" of Jasper townsite.

After completing the survey of the corrals, I commenced topographical work, which I did by the transit-stadia method. Closed traverses were run, and from the stations of the traverses numerous side shots were taken to locate the contours. Rough sketches of the country were made. From the traverse notes and sketches regular topographical maps were afterwards constructed. I first traversed Cabin lake and a considerable area around it. I afterwards traversed Miette river for a distance of about four miles, commencing at its mouth; I also traversed both sides of Athabaska river for a distance of about four miles above and below the town, and the chain of lakes on the east side of the river. I ran other traverses to locate contours in the country adjacent to the lakes and rivers. I used the Grand Trunk Pacific Railway bench marks as data for elevations. I checked my elevations obtained by stadia by ties on these bench marks wherever convenient. I also ran a line of levels from one of them to Cabin lake.

On January 6, I had completed all of the work on the flats of Athabaska and Miette rivers, which could be conveniently done from my camp at Jasper. I therefore closed operations and on January 8 arrived in Edmonton, where I disbanded my party.

APPENDIX No. 36.

ABSTRACT OF THE REPORT OF C. F. MILES, D.L.S.

INSPECTION OF CONTRACT SURVEYS AND MISCELLANEOUS SUBDIVISION.

The surveys performed by my party during the past season were distributed over the provinces of Manitoba, Saskatchewan and Alberta.

I arrived at Prince Albert on May 19, 1913 and after organizing my party and purchasing supplies left on the 22nd for Mistatim by the Canadian Northern railway.

My first work consisted of making corrections in townships 45 and 46, ranges 9 and 10, west of the second meridian. Much of this land is burned-over swamp and is not suitable for immediate settlement without drainage. We were engaged on this work until June 21 and on the 23rd left for Dauphin. From there we went to Winnipegosis where we secured a sailing vessel, and left for contract No. 13 of 1912 in townships 34, 35 and 36, ranges 16 and 17, west of the principal meridian. It is a pleasant sail up lake Winnipegosis; the water is not very deep along the route we followed, the main channel for vessels lying more to the west. I was informed that great quantities of whitefish are caught and shipped by rail from Winnipegosis every fall and winter, giving employment to many fishermen and teamsters. Settlements are extending along the west shore of the lake, but as yet only a few settlers are located on the east side. However, now that the country east of the lake has been subdivided, there is a fair promise of it becoming settled. During the inspection of this contract we had a good deal of rain and cloudy weather, so that it was impossible to observe for azimuth, except on the morning of June 6 before our departure for Winnipegosis.

We then returned to Dauphin, arriving there on the evening of the 7th. The country between Winnipegosis and Dauphin appears to be very flat, and owing to frequent rains there was much water on the surface, and the creeks and river were full. We left Dauphin on the morning of July 8, arriving at Edmonton on the following morning.

I had been in communication with the Hudson's Bay company's transport department in order to ascertain the quickest method of reaching McMurray where my next work was located. I was informed that their scow brigade would probably leave Athabaska about July 15, but at Edmonton I learned that it would probably not start until some days later. This delay gave me ample time to secure pasture for my horses. Transport and other articles of our outfit were deposited in the Government storehouse. Necessary supplies having been purchased I started with my party for Athabaska on the 15th. When we arrived I repaired to the Hudson's Bay company's transportation office to make necessary inquiries. There I was informed that twenty-seven scows had to be loaded with about two hundred and fifty tons of freight before they would be ready for departure.

The scows used on the Athabaska are each capable of carrying about nine tons. Each scow is fitted out with four big clumsy-looking cars and one sweep, about thirty feet long and nine inches in diameter at the thickest part, which is manipulated in the stern by the steersman. The scows are fifty feet long and have a beam at the widest part of about thirteen feet. The oars in the scows are not used for propulsion except when it is intended to land, or when some obstruction has to be avoided. The sole motive power is the stream, down which they float day after day, the crews landing only for the preparation and consumption of mid-day meals and for the night.

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We left Athabaska on the afternoon of July 22 and during the first afternoon drifted about six miles camping below Six-Mile island; after that the average was approximately forty miles a day. On the 23rd we passed Calling river where there is a small settlement of half-breeds, comprising four or five families, who live in houses, although retaining the Indian habits and customs of hunting, trapping and fishing. In summer, during the season of navigation, they are employed as boatmen on the different scow brigades, which are owned mostly by fur traders who take their goods down almost to the farthest limit of fresh-water navigation. These scows are rarely ever brought back, the steamboats that run below McMurray being utilized for the return trip as far as McMurray. Above this point the free traders, as distinguished from the Hudson's Bay company, have to bring their furs up to Athabaska in their own scows by tracking, the company declining to carry a free trader's furs in their scows.

In summer the mail is carried by canoe once a month from Athabaska to McMurray, but there are no offices on the river between these two points. In winter it is carried by dog-train via Lac LaBiche settlement to McMurray.

At Calling River settlement there is a general store, fairly well stocked with provisions, dry goods, etc. Mr. Peter Prudens the owner of this store does some farming on a limited scale; he grows sufficient oats for his own use, as well as potatoes, cabbages, turnips, carrots, etc., both for his own use and for sale. He has grown wheat very successfully but there is no market for it. The Dominion Government telegraph line crosses the river here and the right of way is cut out all the way from Athabaska. Most of it is passable for wagons, but the banks of Deep creek cannot be crossed with teams. The telegraph line is said to be opened as far as the nineteenth correction line.

We passed two oil-boring outfits, the first one on the right bank, and the next one on the left bank near Pelican portage. Neither of these outfits have struck oil yet but the one at Pelican rapids has struck a considerable flow of natural gas. The first oil-boring outfit is about eleven miles and the other about three miles above the rapids. There is another outflow of natural gas about twenty miles below Grand rapids, near Buffalo river, on the left bank of the Athabaska; there at the edge of the river the gas exudes, and can be lighted with a match. At Pelican portage just below the rapids there is a settlement of seven or eight families, nearly all half-breeds. From there a winter road leads to Wabiskaw Lake settlement. Goods are brought down from the Athabaska by steamer in summer and when winter sets in are freighted across the portage with sleighs to Wabiskaw, a distance of about seventy miles.

Forty-one miles below Pelican rapids is the mouth of House river, which is as far as the Hudson's Bay company's steamer *Athabaska* runs. A quantity of freight is usually taken there by the steamer when the water is fairly high and is then freighted by team over the trail to McMurray. This trail was at one time an Indian pack-trail, but recently it was opened out as a sleigh road. The Hudson's Bay company have at House river a large shed covered with tar paper and there are in the vicinity three or four half-breed families engaged in hunting and trapping. The soil there has not been cultivated to any extent, although potatoes have been grown successfully.

Nine miles below House river the Grand rapids commence. These are very formidable rapids, having a fall of about fifty feet in half a mile. An island lies in the rapids, and by far the greater body of water passes down on the west side of the island. The channel on the east side is not more than three chains wide. The loaded scows are all tied up about a mile above the island whence they are run down singly between big boulders and rocks, to the head of the island, where there is a tramway laid up to near the water's edge. The freight is then loaded on a car and pushed down to the foot of the island, while the empty scows are run down the east channel to some comparatively still water which lies behind a point of land jutting out from the east immediately below the island. At the foot of the island floats in the shape of logs, are attached to the end of a long rope and thrown into the water. They float down through part of the turbulent water into the eddy behind the point jutting out from the east, where

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they are taken aboard a scow, which is allowed to float out into the current. Fifty or more hands then take hold of the rope, now attached to the scow, and pull her up to some bare rocks jutting out from the lower end of the island where she is again loaded with freight. This work does not occupy as much time as one might imagine, but every parcel of goods has to be carried on a man's back from the tramcar to the scow, a distance of two or three chains. Merchandise and provisions are as a rule done up in fair-sized packages, but there are other articles, such as stoves which are of considerably greater weight; they have also to be carried on the backs of the men, some of whom may be seen running down the incline with three, four or even up to five hundred pounds of flour on their backs. It is not a smooth path either, as the men have to step from stone to stone and rock to rock.

All of the twenty-eight scows were reloaded by the afternoon of August 2, when we continued our journey down stream. The banks of the river appeared to increase in height as we proceeded down the river, and at a point not far from McMurray the aneroid reading showed the depth of the valley to be over 500 feet. After passing all the remaining rapids, of which the Cascade is the most formidable, we arrived at McMurray, on the morning of August 5.

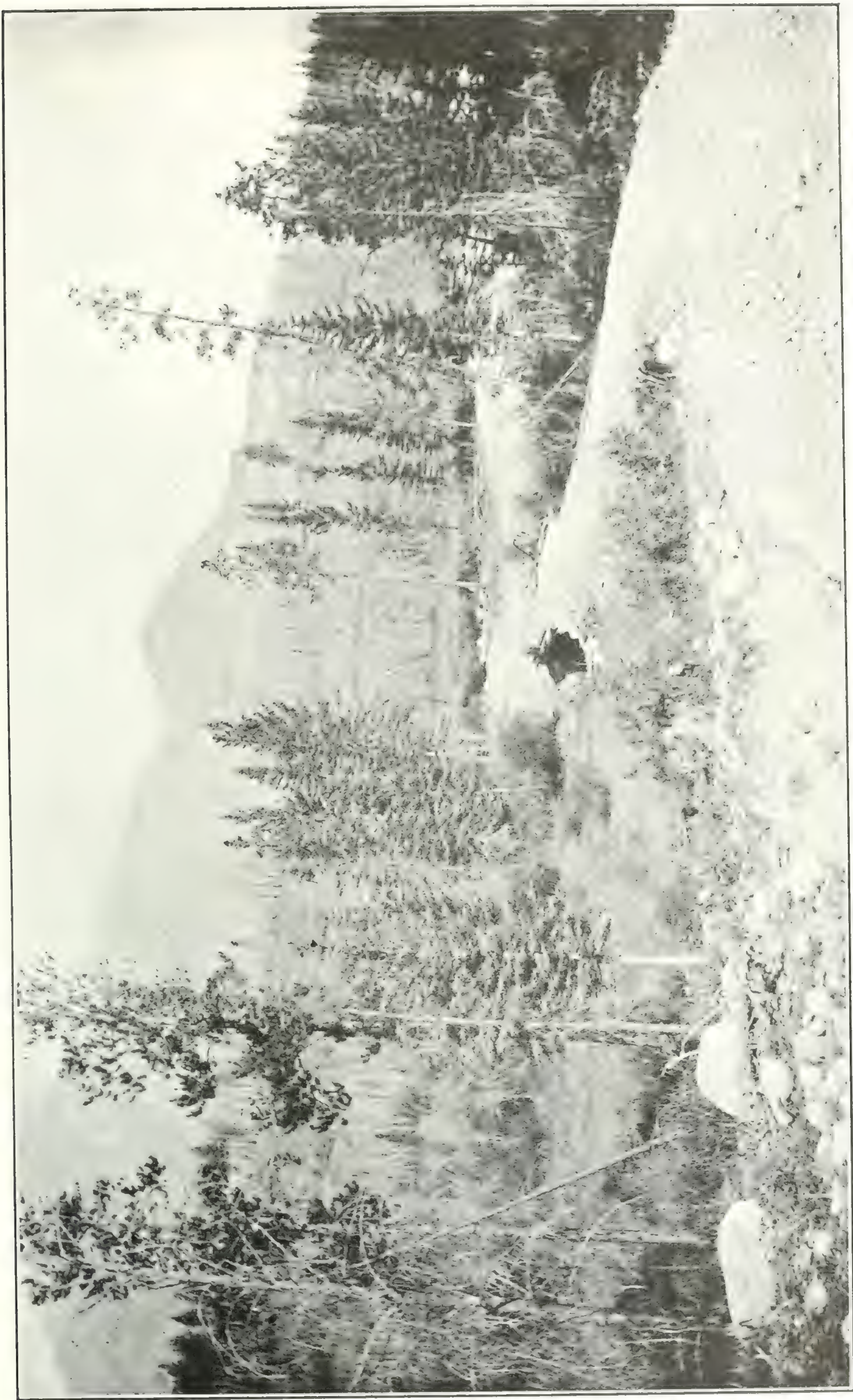
From this place I proceeded to the inspection of Mr. Tremblay's contract No. 33 of 1912. I hired two canoes and left McMurray in the afternoon and after tracking, poling and paddling up a very rapid current arrived at our destination seven miles up Clearwater river. We camped on the twenty-third base line where it intersects the Clearwater in section 36, township 88, range 9, west of the fourth meridian.

The immediate banks of the Athabaska at McMurray and for some distance up are not very high. The settlement lies on a plateau about forty feet above the level of the river and extends easterly for several miles. There are four stores at McMurray proper, besides a Roman Catholic mission; about two miles farther east there is another store or two. At this place which is called "The Prairie;" there are a number of settlers, carrying on farming on a small scale. Up the Clearwater there are also a number of squatters, most of whom appear to be there for speculative purposes rather than with the intention of becoming permanent settlers. The proposed construction of a railway from Edmonton to McMurray in the immediate future, appears to have created a considerable demand for land in that district.

We concluded our inspection of this contract on August 10, and returned to McMurray that evening. On the following morning the scow brigade, now reduced to eight boats, started up stream. Six of these were laden with fur, brought up from the Hudson Bay company's most northerly stations. The other two were cook scows, one for supplying meals to the passengers, and one for the crew. Each scow was pulled up stream by a crew of ten or twelve men who tramped along the edge of the water. At the "Cascade" all the scows were unloaded as the water was considerably lower, and all the goods, principally bales of fur, and the passengers' baggage were portaged a short distance up the shore while the scows were hauled up by the combined crews. This occupied nearly a whole day.

After passing Cascade, Crooked, Middle and Brulé rapids we finally reached the foot of Grand rapids, the last and also the most formidable of all, on August 20. Here we were delayed until the 23rd, on account of all the cargoes having to be portaged about a quarter of a mile and the scows tracked up stream with a crew of fifty men each. Above the rapids we met the Hudson's Bay company's steamer *Athabaska* in which both crews and passengers, amounting to a total of between 200 and 250 persons, were taken to Athabaska where we arrived about noon on August 25.

After re-organizing my party we again left Athabaska on September 13 via Athabaska river for LaBiche river where we arrived the following day. There is a good pack trail from the mouth of LaBiche river to Lac LaBiche settlement; in fact it has the appearance of having at one time been utilized as a wagon or sleigh road. We packed along this trail about five miles, where we camped, and from there completed



Phot. by H. M. M. M. M. M.

Road to Pyramid Lake in Jasper Park, Alberta.

Pyramid lake is situated in township 45, range 1, west of the Sixth meridian four miles from Jasper. The road from Jasper, which is a dirt road, is in the Park and has been built for tourist traffic, is a splendid road for automobiles, and has very easy grades. In the foreground of the picture, the road is covered with evergreen trees.

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the subdivision of that part of township 70, range 18, west of the fourth meridian, lying south of LaBiche river. On September 29 I received instructions to subdivide township 73, range 19, west of the fourth meridian, I therefore sent my packers with the horses to a point near the nineteenth base line. We broke up camp the following morning, and started down the river with our scow, arriving at the nineteenth base line pack trail on the morning of October 1, the horses having arrived on the opposite shore the night before. We swam the horses across, built a stage for a cache, unloaded the scow, and got everything ready to move into the work. The next morning we moved to the southwest quarter of section 2, township 73, range 19 and commenced subdivision. On the night of the 3rd and the two following days there were flurries of snow which lodged in the trees, and made it somewhat disagreeable for the line men. On the 8th as the work was progressing favourably I started for Athabaska to lay in a further supply of provisions and to purchase some sleighs, which I knew would be required later on. We tracked up the river with a borrowed canoe, arriving at Athabaska on the 11th. I had to purchase another scow and a canoe to carry the provisions, sleighs, harness, etc., back to camp. We left Athabaska on the 18th arriving at my cache, near the nineteenth base line on the 23rd.

The party returning to camp from their day's work crossed a lake on the ice on the evening of the 25th. On the 26th snow fell all night and continued all the following day, so I sent all the party down to the river cache, to haul up the scows and secure them for the winter.

We continued the subdivision of township 73, range 19 and completed it on December 5. This township is fairly level and there is some good soil, but the larger part of it consists of swamps. Very little of the land, west of Athabaska river and below Calling river, will be available for settlement, until either a road or a railway has been constructed on that side of the river. The banks are so high, that it is almost impossible to construct a wagon or even a sleigh road from the river to the plateau above. For this reason the small areas of excellent timber which grow all along the plateau, can not be utilized at present. Judging by the signs and tracks in the snow there is game in abundance, but while we were engaged in the subdivision, four large timber wolves appeared and this had the effect of driving all the deer away. Up to November 21 the lowest temperature was 2° above zero, but on the following morning it dropped to 5° below.

On December 11 we left for the inspection of contract No. 15 of 1913 in townships 70 and 72, ranges 18 and 19, and reached there on the 15th. We completed this inspection on the 23rd and left for Athabaska on the following morning. On our way to Calling River settlement, we passed Mr. Kraemer's fox farm, on the east side of the Athabaska. He had in captivity twenty-seven wild foxes, varying from common red, to cross and silver grey, some of them quite valuable. Owing to my horses not being shod, we could not take the outfit up the Athabaska on the ice, so we had to make a detour by way of Calling lake and thence south, striking the river about twelve miles below Athabaska which we reached on December 27.

While there I purchased supplies and horse feed, engaged a freighter to carry my goods to Moose portage and had my horses rough shod for travelling on the ice.

We left Athabaska on January 2, 1914, for contract No. 14 of 1913, which we inspected and then proceeded to contracts Nos. 13, 12 and 11 of 1913, completing this work on February 18. These four contracts lay in townships 69 to 73, ranges 23 to 27, west of the fourth meridian and range 1, west of the fifth meridian. While engaged on this inspection we experienced the coldest weather of the winter, the thermometer registering 51° below zero for three days. Port Cornwall which was formerly known as Mirror Landing is a new town consisting of several hundred inhabitants situated at the junction of Lesser Slave and Athabaska rivers, in township 71, range 1, west of the fifth meridian. It has a number of stores and a telegraph office, and is on the direct road from Athabaska to Grouard. It lies opposite Smith, a still newer town consisting

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mostly of log buildings, on the south side of the river. This is the present terminus of the Edmonton, Dunvegan and British Columbia railway and is the point where the new railway bridge crosses the Athabaska, said to be 131 miles from Edmonton. This town appears to be the headquarters of the railway company and will be a divisional point. Trains are running on this road to Edmonton every alternate day, but only freight is hauled. Much of the freight so far comes up the river from Athabaska to Port Cornwall, thence to Grouard by way of Lesser Slave lake and on to Peace River Crossing. Sleighs and automobiles are met frequently on this trail. Nearly all the settlers along the river keep stopping-places for man and beast, and they are frequently overcrowded. Much of the country fronting on the river is burned over, the banks on both sides being considerably lower than those below Calling river. There is a fairly large settlement back of Moose portage. The soil is productive and some good crops have been grown, as well as vegetables of excellent quality. Most of the settlers combine with their farming operations, freighting, fishing, hunting, trapping and taking out railway ties, and fuel for steamboats.

We arrived back at Athabaska on February 20. After procuring further supplies and horse feed we again started down the river on the 25th for contracts Nos. 16 and 17 of 1913, both lying along the river below the nineteenth base. We reached there on March 2, and camped on section 4, township 74, range 18, west of the fourth meridian.

The valley of the river in this vicinity varies from 400 to 500 feet in depth, and the banks are generally steep. The plateau above is nearly level, and consists mostly of swamp lands, wooded with spruce and tamarack. The higher areas are covered with poplar and spruce. Small areas of very good timber are found, more particularly in the northern plateau. This will not be available for manufacturing purposes until railways are constructed to carry off the manufactured product.

Athabaska river was in excellent condition for travel at this season, freighting teams carrying loads of three tons and over. A great deal of traffic was carried on from Athabaska to Pelican portage, a distance of about 120 miles, thence to Wabiskaw, about 70 miles, and also from Athabaska to Old House, and thence overland to McMurray. This traffic affords the settlers around Athabaska a good opportunity for employment for their horses during a few months of the winter. Much of this traffic will cease as soon as the Edmonton-McMurray railway is constructed.

Access to any of the lands subdivided down the river from Athabaska can only be had by the river, which is the main highway at the present time for entering these new townships. Those subdivided up the river may be conveniently reached by the newly constructed Edmonton, Dunvegan and British Columbia railway.

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APPENDIX No. 37.

ABSTRACT OF THE REPORT OF J. B. McFARLANE, D.L.S.

BASE LINE SURVEYS IN NORTHERN ALBERTA.

My work during the past season consisted of the survey of parts of the twenty-fourth and twenty-fifth base lines west of the fourth meridian.

I left Toronto on April 3, 1913, but as the ice on the Athabaska was a little later than usual in breaking up, I did not leave Edmonton until the 23rd. This early start was of little avail, as the water was very low and the trip to McMurray in scows a very laborious one. It took twice as long as the same trip the previous year. Few outfits went through without all of their boats suffering more or less damage, and some had the misfortune to have scows sunk. At Grand rapids only a small portion of a scow load could be taken through the last mile and landed at the portage. Consequently we had to make many trips. Below the rapids the water was so shallow that the scows were continually grating on rocks or gravel, and we had to leave one load behind to be brought down at high water, as we had not enough men to handle the scows quickly enough in the continuous rapids. At the Boiler rapids our steersmen successfully used a new channel. At the Little Cascades each scow stuck at the drop and had to be partially unloaded. At the Cascades two-thirds of each load had to be portaged about twenty chains and lowered thirty feet over an ice cliff into the scows and even then the scows stuck at the drop, which was about six feet.

We reached McMurray on May 14, and my horses, which had left Edmonton on April 14, arrived the following day. On the 16th we camped at the mouth of Steepbank river. As practically all the country between there and the end of the twenty-fourth base line in the middle of range 6 was muskeg, we followed Steepbank river. This led us a long distance south of the base line, but as we were sure of running into no impassable muskegs, I decided that this was the quickest way to take the outfit. At the forks of the river we followed the north branch, which took us within a few miles of the end of the line. On June 5 work was commenced on the line by retracing the north boundary of section 34, township 92, range 6.

The country through which the twenty-fourth base line was run this year was about 90 per cent muskeg. A few sand ridges run north and south across the line in the west half of range 6. These mostly face the west and have most of their fall in that direction. This half range and range 7 are drained to the south by the north branch of Steepbank river and its tributary creeks.

This country is, as a rule, flat with a few low sandy or gravelly ridges. Those running north and south have their fall to the west and others scarcely rise out of the muskeg. In the summer of 1912 a fire completely overran the northeastern part of this district crossing the line from the centre of range 7 easterly. As that was a dry summer the moss in the muskegs burned well and all trees except those in the very wet tamarack swamps, were killed. The timber throughout this stretch of country was small and stunted except on the scattered ridges, where patches of good spruce, jackpine and poplar timber were destroyed.

Immediately following fires in this country the grass springs up in the burnt muskegs, and I have no doubt that if the fires were frequent enough to keep the moss and trees from growing, a good ranching country would be formed. Old patches of *brulé* testify that grass will grow luxuriantly on the burnt muskegs until smothered out again by the growing scrub.

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Township 93, range 8 and almost all of township 92, up to the high banks of Steepbank river, are drained to the north away from the river, and many creeks rising in this district flow north or northwest to join Muskeg river. Throughout this district the timber, mostly spruce, is thick and small, probably large enough for pulpwood, but not suitable for timber except in narrow bands along some short slopes, or along creeks where the banks have sufficient drainage to allow the timber to grow.

Range 9 is crossed in a west by northwesterly direction by the deep valley of Steepbank river with the river itself coming near the line at the west of the range, but not touching it. The river valley is generally one-half to three-quarters of a mile in width with high banks and steep slopes, and the more level portions are generally well timbered with spruce. The valley is much the same from the mouth of the river bank to the forks of the north and east branches, only its depth and width gradually decrease and the timber becomes more broken with patches of small poplar and jackpine. The north branch soon loses its valley and its banks become gradually lower until they form part of the muskeg. There is very little timber along this branch.

In range 10 the Athabaska crosses the line in section 35. This great river averages about half a mile in width in this vicinity, and is always navigable for steamboats past this point. Its flow at high and at low water differs immensely and an estimate of the one without the other would be very misleading. The channel is always well defined and scarcely ever is any land flooded. Patches of spruce timber up to three feet in diameter are scattered along its banks, and a small but valuable limit, easily accessible, could be had on the flats just north of the mouth of Steepbank river. The river flats are generally about a mile wide with the river sometimes on one side of the valley and sometimes on the other. Many of these flats have large lagoons or lakes with marshes or swamps around them and only a narrow neck of dry ground separating them from the river. At La Saline, about three miles north of the line, a very large hay meadow adjoins a small lake and at several other places there are smaller ones. Last summer however, was so wet that very little hay could be put up as most of the meadows in the north country were flooded.

The banks of the Athabaska valley are about two hundred feet high in this district and in some places are quite steep. There are a number of projections of limestone along the valley and in the river banks, in the vicinity of the twenty-fourth base.

Above the hill, west of the river, there is a stretch of wet tamarack muskeg reaching a long distance to the south and three or four miles to the north. Its width at the line was ninety chains, with only one small jackpine ridge in the middle. A trail was not made across this muskeg but the line was finished, as far as instructions called for, from a flying camp in the next range. A small river known locally as Beaver river, flows almost due north along the east side of range 11, having its source northwest of McMurray and emptying into the Athabaska about a mile below Muskeg river. The valley is about thirty feet deep and less than a quarter of a mile wide with a few chains of flats. Across the remainder of this range the line followed close to a creek with poplar and spruce timber averaging ten inches in diameter along its banks. Back from the creeks, which only drain the land for a short distance on either side, much of the land is muskeg with stunted spruce or tamarack. An old Indian trail for pack-horses crosses the line just west of Beaver river. It runs from McKay to McMurray, following the Beaver almost to its source, thence southeast to McMurray.

Levels were run along the line starting at the last bench-mark established in 1912. Bench-marks were established, as nearly as possible, at every half mile and check levels were run in the opposite direction between these. The elevation which starts at 2,010 feet drops gradually but almost continuously for twenty-one miles till it is 1,100 feet just above the banks of the valley of Athabaska river. The valley is a little less than two hundred feet deep the left bank being the higher. Then the elevation remains about the same until Beaver river is crossed whence there is a gradual rise to 1,292 feet at the end of the line.

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On August 5 the twenty-fourth base line was completed through range 11 which was as far as instructions called for. The move to the twenty-fifth base line was then commenced. On the way down the Athabaska we stopped at La Saline for five days and put up hay, as it was impossible to get any one at McMurray to do this for us, although promises were easily obtained. A party of five men with fourteen horses and a scow load of supplies had left the twenty-fourth base line on July 10 to cut trail and pack supplies along the twenty-fifth base. After building a cache on the Athabaska in the vicinity of the latter base we followed their trail and overtook them on August 25 about the middle of range 6. This far the trail had followed close to the line but there we had to swing to the south around a large muskeg basin and follow along some ridges which form a watershed but which are completely covered by muskeg, thence east to Firebag river and thence northeast through a range of jackpine hills. We reached our most easterly camp on the twenty-fifth base on September 8 and on the following day the east boundary of section 36, township 96, range 1, was retraced and the corners moved 4.34 chains north.

The pack trail from the Athabaska was built with great difficulty and travelled with more difficulty and almost all of the party got wet at one time or another by a horse going through or off the corduroy. Fortunately this country was frozen up fairly solid before the line was run through it.

In range 1 the base line runs mostly through sand hills and the two townships to the north are much the same. These townships were completely overrun by fire in 1912. Firebag river, which at this point is about seventy feet wide, three feet deep, and has a current of about one mile per hour, crosses the line in section 34 running northwesterly and then back again in section 33. From there it takes a sweep to the south and winds through a large muskeg which is too wet to have timber of any size on it. In range 2, townships 96 and 97, are both crossed east and west by ranges of sand hills with a wide stretch of muskeg and long stretches of tamarack swamp between them and directly along the line. Firebag river leaves the large muskeg about the middle of the range and swings around south of the hills in township 96. It runs in a small valley through low sand ridges. Range 3 is much the same as range 2 with muskeg along the line and sand hills to the north and also along Firebag river to the south. This river runs in a west by northwesterly direction until it is about a mile and a half south of the line at the west boundary of the range. Near the middle of township 96, range 3, it is joined by a large tributary from the south. It crosses range 4 in a west by northwesterly direction in section 33. Its width is about one hundred and forty feet, its depth two feet and it has a current of about one and a half miles per hour. The muskeg to the east follows the line to the river. The country to the south of the river is rolling and sandy with small muskegs sloping off to a large muskeg basin to the southwest. This muskeg includes the central and western part of township 96, range 4, all of township 96, range 5, and the northeast half of township 96, range 6. It is drained to the north by creeks running into Firebag river. In township 95, across these ranges, is a wide shallow depression draining to the east and to the west. North of the line Firebag river winds in a west by northwesterly direction through a narrow valley with many cut banks. A range of jackpine hills follows the north bank of the river and back of these the country is rolling with creeks or muskegs in the valleys. The greater part of range 7 is dry country. A range of rolling hills covers the eastern part of township 96, range 7. These hills become higher and rougher north of the line and widening out in range 6 and to the west side of range 7, extend north to Firebag river which turns more to the north in this range being joined by the north branch near the north boundary of township 98, range 7.

Much of this hilly country was overrun about three years ago by a fire which killed a large quantity of good spruce timber. The soil on the rougher hills to the north is mostly sand but in the vicinity of the line there was a fair coating of loam and

in many places grass stood three feet high among the fire killed timber. Grass springs up quickly in the burnt muskegs and I think a large proportion of this district could easily be turned into a good ranching country.

The main branch of Muskeg river flows out of Muskeg lake which is about three miles long and a mile wide, and is located about the northeast corner of township 95, range 8. This lake is fed by a large creek from the east. The river is very crooked and from the lake flows northeasterly between dry banks in a rolling country until it nears the base line. There it turns northwesterly amidst the beginning of the large stretch of muskeg from which it derives its name. Where it crosses the base line in section 35, range 8, it is twenty-one feet wide, eight feet deep and flows one-eighth of a mile per hour. At its most northerly part it is joined by the north branch, and from there flows southwesterly across the line and keeps about the same direction to its mouth. It has very little current and is almost dead water except when flooded by rains; it then fills its low banks which are all muskeg and show nothing but vegetable formation below. The water in Muskeg river is always dark coloured and is rather stagnant in winter. Water in the small lakes also becomes stagnant in the winter but all the running creeks had good water. A continuous wide stretch of muskeg follows Muskeg river from the jackpine hills along the Athabaska northeasterly to the source of the north branch. Between the two crossings of the river the line traverses a tamarack and willow swamp.

A range of rolling hills stretches along the line from section 35, range 9, to section 32, range 10. These are covered with thick jackpine, poplar, spruce and birch averaging about ten inches in diameter. In range 9, most of these hills were overrun by a fire in the summer of 1912, which was very dry. This fire burned across the muskeg at Muskeg river and ran off towards the southeast to the twenty-fourth base line. The hills drop down to a lower level about three miles north of the base line and a low stretch of land drains towards the north branch of Muskeg river.

The Athabaska crosses this base line in section 36, range 11, running almost due north. Through townships 95 and 96 jackpine and poplar hills follow the east bank of the river. These gradually drop into muskeg about one mile south of the line. This is the point where our trail leaves the river and where we placed our cache. The river banks are about one hundred feet high and are steep. They are usually close to the channel and have but little valuable timber on them.

In ranges 11 and 12 the line ran through an undulating country covered with thick jackpine, poplar, spruce and tamarack averaging about eight inches in diameter. The country, back from the rivers and creeks is cut up by muskegs, and the creeks in some places spread out in large willow flats.

Calumet river drains the townships north of the line and Tar river those immediately to the south. Both are short streams rising in Birch mountains. This range of mountains will apparently cross the base line about half way between the west boundary of range 12 and Moose lake. They run in a northeasterly direction.

A strip of good spruce timber about twenty chains wide, with the trees averaging from fourteen to twenty inches in diameter, extends along the narrow valley of Tar river across these ranges.

A sleigh trail was cut from the Athabaska to section 35, range 12; this crosses several muskegs but probably a good pack trail could be made following Tar river which crosses the line in section 31, range 12.

Scarcely any of this country would be suitable for agriculture on account of summer frosts and the difficulty of draining and clearing it, but I think a good deal would be suitable for ranching if cleared enough to give the grass a chance to grow.

Rainfall was plentiful throughout the whole season and the snow was about fourteen inches deep on January 15, 1914. No land is flooded by creeks but the muskegs are well filled by heavy rains.

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Mineral claims are numerous along the river but the only minerals much in evidence yet are salt and tar sand or asphalt. These appear to be well distributed. Wood fuel is everywhere plentiful. Game and fur-bearing animals are plentiful, and hunting and trapping is largely carried on among the Indians in this district. An industrious and capable trapper can make from one thousand to twenty-five hundred dollars in a season.

No valuable water-powers were found this season. Dams could be built but it would be difficult to get much head. No stone-quarries are opened up and no other industries are started yet although there has been considerable drilling for oil along the Athabaska.

Levels were run along the line and bench-marks established wherever possible near each half mile post and check levels were run in the opposite direction between them. From the elevation of 1,871 feet at the fourth meridian the fall is rapid, to 1,713 feet at the west crossing of Firebag river in section 33, range 1. A hill just west of the river rises to 1,773 feet. From there to the west side of range 3 there is little change in elevation. In range 4 the elevation drops steadily to 1,539 feet at Firebag river. This elevation is again reached three miles west of the river and the elevation then drops steadily to 1,344 feet at the middle of range 6. The hills at the east of range 7 reach an elevation of 1,405, but they slope rapidly to the west. At the crossing of the east branch of Muskeg river the elevation is 1,142 feet and at the crossing of the main river 1,090. Across range 9 the line follows through rolling country draining to the southeast. An elevation of 1,304 feet is reached on section 35, range 10 and from there the slope is towards the Athabaska the elevation of which was 897 feet. West of the Athabaska the land rises gradually to the Birch mountains, with only small local depressions; at the west of range 12 the elevation is 1,818 feet.

On January 15 the twenty-fifth base line was completed through range 12 and as no hay or feed was procurable at McMurray or farther north to continue the survey of the twenty-sixth base line, I decided to close operations for the season. It took four days travel to reach McMurray. We left there on January 21 and in six days and a half we reached the portage to House river. This is a new trail and is still rough. Hay was scarce at McMurray and on the trail as the Hudson's Bay company were holding all they could get in order to do their own freighting. Our horses were on short rations of hay and a moderate amount of oats until we reached Colin river where hay was plentiful. We reached Athabaska on February 5 and Edmonton the following evening.

APPENDIX No. 38.

REPORT OF R. B. McKAY, D.L.S.

SURVEYS IN THE RAILWAY BELT, BRITISH COLUMBIA.

VANCOUVER, B.C. February 11, 1914.

E. DEVILLE, Esq., L.L.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report on my survey operations for the season of 1913.

My first work which was commenced on May 17 consisted of the survey of two small parcels of land withdrawn from timber berth No. 553 in sections 30 and 32 of township 17 east of the coast meridian, which had been squatted upon and partly cleared. The land in this vicinity is rather hilly, and is timbered with fir, cedar, hemlock, alder and maple. The soil is well suited for growing fruit and vegetables. A saw-mill was being constructed preparatory to logging the timber of the locality during the following winter. These parcels are situated about three miles from Mission Junction, a town on the Canadian Pacific railway, with a population of about 1,200. It serves as a local market for the produce of the settlers who are engaged in fruit growing, dairying and mixed farming. Fruit growing is the main industry, and the district is noted for the success it has attained in this line.

On May 23 I proceeded to township 21, east of the coast meridian, to establish the east boundary of the western tier of sections in this township, and complete the survey of these sections. The eastern halves of these sections occupy the westerly slope of a steep mountain ridge covered with fir, hemlock, cedar and alder, mostly second growth, interspersed with some large burnt fir. The land for the most part is rocky and unfit for agricultural purposes. There is some good land suitable for fruit or vegetables in the westerly half of sections 19, 30 and 31, but the remainder of the township is mountainous and of no agricultural value.

On June 27 I moved camp to Coquitlam to make a preliminary survey of a proposed subdivision of land withdrawn from timber berths Nos. 77 and 86 in sections 11, 12 and 14 of township 39, west of the coast meridian. This land has been "logged." The soil is a sandy loam, gravelly in places, with gravel subsoil. It is suitable for poultry ranching and fruit land, and where not gravelly for vegetables. It should also make good home sites, as it is situated about two miles from Westminster Junction on the Coquitlam pipe line road and adjoins the limits of the growing town of Port Coquitlam which has recently experienced a boom due to the Canadian Pacific Railway company establishing railway shops and yards there. This town extends to Pitt river where dredging operations are in progress. The ship-building industry has been started and the erection of grain elevators is contemplated.

On July 22 I moved to Port Moody and thence across Burrard inlet to "Sunnyside," where I examined a parcel of land which has been withdrawn from timber berth No. 52, in sections 20, 21 and 16 of township 39, west of the coast meridian and which it is proposed to subdivide into twenty acre blocks. This land is situated about 600 feet above Burrard inlet and is reached by the old Buntzen lake trail, or skid road, which connects with the Port Moody road on the north shore of the inlet where a gravel plant is in operation. The soil is light, sandy loam, rather rocky or gravelly in places and is suitable for poultry ranching, fruit growing and gardening and should make good

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home sites for the people of Port Moody where lumbering and oil refining are at present the main industries.

I finished my preliminary survey at Port Moody on August 8, and after increasing my party, proceeded to Columbia valley, establishing camp in section 7 of township 22, east of the coast meridian. From this camp I made surveys of eighteen parcels of land withdrawn from timber berth No. 55 and situated in section 1 of township 19, and sections 4, 5, 6, 7, 8, 9, 15 and 16 of township 22. These parcels were from twenty to eighty acres in area, and were laid out as legal subdivisions or aliquot parts thereof, in such a way as to include the improvements of the squatters on the land. Some of these squatters were attracted to this locality over twenty years ago and although the land has not been open for entry, as it was included in a timber berth, they have remained on their holdings and have annually grown good crops of vegetables and fruit. The climate is mild and rather wet, and the soil is very fertile in many places. When the timber is removed and the land thrown open for settlement, the remaining land in the valley will be quickly taken up. There is a dense growth of large fir and cedar in parts of sections 6, 5, 4 and 9, estimated as high as 150,000 feet per acre, but elsewhere the larger trees are more scattered. The amount of merchantable timber is annually growing less as much of it is decaying and should have been logged years ago. The nearest market for the produce of the district is the town of Chilliwack, fifteen miles distant, which is reached by a road which skirts the eastern shore of Cultus lake.

On September 14 I moved up to the north end of Cultus lake, where I surveyed three parcels in sections 35 and 36 of township 22, east of the coast meridian, and two parcels in section 30 of township 25, all of which were being withdrawn from timber berth No. 55. Here also a good portion of the land will make first class fruit land when cleared. The soil is rich and suitable for garden products of all kinds.

On September 23 I moved camp up Chilliwack river to the end of the Mt. Baker wagon road, in section 34 of township 1, range 29, west of the sixth meridian. There I surveyed three parcels in sections 33, 34 and 27 of this township, and one parcel in sections 32 and 33 of township 1, range 28, all of which were being withdrawn from timber berth No. 50. There are few patches of land in the valley of Chilliwack river in this vicinity which are level enough to be of use for agricultural purposes. The soil is rich and consists usually of clay loam with clay subsoil, and is suitable for all kinds of garden products. The timber is the main resource of the district, large fir and cedar up to four feet in diameter being found on both sides of the river and particularly on the higher benches.

On October 4 I moved to Majuba hill and camped in section 29 of township 22, east of the coast meridian. From this base I surveyed one parcel in section 12 of township 19, and seven parcels in sections 20, 29, 28 and 34 of township 22. This district is easy of access, as it is served by a good road and also by the British Columbia Electric railway. Fruit raising, dairying and mixed farming are engaged in by the settlers. I completed the survey of these parcels on October 25.

I then retraced the east and north boundaries of section 27, township 23, east of the coast meridian, and the northerly boundary of Commonage Indian reserve in that section, and traversed the islands of Fraser river in sections 9, 10, and 15 of township 3, range 30, west of the sixth meridian. Some years ago the channel of Fraser river in these sections was along the left bank, but it has now shifted to its right bank, with the result that the large islands which originally existed have been practically reduced to sand bars and the former channel of the Fraser is occupied by recent deposits of gravel, sand and silt. I also made some traverses in section 4 of this township. Fraser river is navigable through these sections only in high water.

I left this district on November 7 for Deroche, where I traversed three small islands in Nicomen slough in section 8 of township 24, east of the coast meridian.

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There a saw-mill is in operation, and the settlers in the vicinity are engaged in raising garden produce and dairying.

On November 10, I moved by the Canadian Pacific railway to Port Moody, where, after experiencing considerable unfavourable weather, I completed, on November 30, the subdivision of the forty-one twenty-acre lots withdrawn from timber berth No. 52, which I had investigated earlier in the season.

I then moved to Coquitlam, where I laid out thirty-four lots on the land withdrawn from timber berths Nos. 77 and 86, which I had also previously examined, and, having finished this, I returned to Vancouver and disbanded my party on December 13.

I have the honour to be, Sir,

Your obedient servant,

ROBT. B. McKAY, D.L.S.

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APPENDIX No. 39.

ABSTRACT OF THE REPORT OF A. M. NARRAWAY, D.L.S.

MISCELLANEOUS SURVEYS AND RESURVEYS IN SOUTHERN ALBERTA.

On May 7, 1913, I left Medicine Hat for township 21, range 10, west of the fourth meridian.

My work there consisted of a resurvey of this township and a survey of a few section lines not run when the old river-lot lines were destroyed; this was completed on June 10.

Red Deer river runs across this township, and with the coulees on the south side which extend several miles from the river, breaks up the township very badly. It is fairly well settled and good progress is being made by the settlers especially those engaged in mixed farming. On the north side of the river there is considerable difficulty in obtaining water, and most of it is hauled from the river. The branch line of the Canadian Pacific Railway from Bassano to Empress is now nearly completed. This will afford a ready outlet for this vicinity as it passes about five miles south of the river, and the new ferry installed this season by the Government in section 2, township 21, range 11, will accommodate those living north of the river.

My next work, which was started on June 23 and completed on July 10, was a retracement of townships 6 and 7, range 30, west of the third meridian. To reach this location it was necessary to return to Medicine Hat, and thence go southwest past Elkwater lake, and across the Cypress hills. The country along this route is nearly all taken up and good fields of grain were seen. Elkwater lake and the small lakes in its vicinity, backed up by the thickly wooded Cypress hills to the south will make a very pretty and desirable summering place, and no doubt will be used as such by the people of Medicine Hat in the near future.

The Cypress Hills forest reserve cuts off the northerly one-third of township 7, but most of the remainder of the township is level prairie with very rich soil. There is a strip of this level land along the south boundary of the reserve from the east boundary of township 7, range 30, to the west end of the hills; this is known locally as "the bench." At present there is usually a summer frost which prevents the ripening of the grain and this land is being used for hay and green feed. It is the belief of the ranchers and settlers in this vicinity that summer frosts will disappear as the country becomes settled. It is hard to see that this will be the case on account of the large stretch of country immediately to the south which is so rough and rocky that it will probably be used for ranching and not for cultivation. There seems to be an unusual amount of rainfall along these hills which almost completely misses the country more than a few miles away. Numerous springs of excellent water are scattered throughout this district.

My next work, which was completed on July 23, was a retracement of township 6, range 5, west of the fourth meridian. This township is nearly all taken up, and the settlers are making very good progress. They appear to be meeting with great success with their crops. Abundance of good water can be obtained and both coal and wood are convenient. Within a couple of years the Weyburn branch of the Canadian Pacific railway will pass through Manyberries a townsite within three miles of this township.

From this township I went to township 2, range 15, west of the fourth meridian where two township corners were missing and there was a road allowance of abnormal width.

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After dealing with this we moved to township 2, range 9, and retraced townships 2, ranges 9 and 10 finishing on September 3. Milk river passes through both of these townships and with its coulees, which in many cases stretch four and five miles from the river, breaks up the townships so badly that they are unfit for farming purposes. They are admirably adapted to ranching however as is shown by the good condition of the cattle and horses at present grazing there. A great many rattlesnakes are found in these townships; I have sometimes killed ten or more in one day.

From here we went back past Manyberries and retraced townships 6, ranges 3 and 4. These townships are well adapted for ranching and are being used almost wholly for this purpose at present. Feed is a little scarce, but the ranchers claim that there is a great amount of nourishment in what grows. This appears to be the case as the cattle we saw were in good condition.

These townships were completed on October 7 and we returned to Carlstadt and then went north to township 18, range 10, west of the fourth meridian. As had been reported we found that Tide lake had dried up and we produced the section lines across the land formerly covered by water. It is doubtful if this land will be of much use for some time as the settlers state that each spring it is covered with water which stays fairly late in the season.

While in this vicinity we resurveyed the south boundary of township 19, range 9, as the road allowance had been found to be abnormal in several places.

Having finished the work in this vicinity on October 30, we moved to Red Deer river to survey some section lines not run during the original subdivision in townships 21, ranges 11 and 12, and township 22, range 12, west of the fourth meridian. These townships are badly cut up by the river and its coulees. To the north of the river the country is well settled and good progress is being made in spite of the lack of rain, but south of the river the country is all used for ranching.

It is in these townships that the fossilized remains of dinosaurs and other of the prehistoric animals are to be found, and while running our lines we found some very good specimens.

We completed these townships on November 28 and then moved to Lethbridge by way of Brooks. Here we traversed the left bank of Belly river across sections 25 and 36, township 8, range 23, as the river had changed its course in several places.

From here we went to Macleod, reaching there on December 6. We commenced the traverse of Oldman river on the 10th and continued it across townships 9, ranges 26 and 25, and township 10, range 25, west of the fourth meridian, completing it on December 27. We found that the river had changed its course in many places and that some of the islands had been joined to the main land.

I closed operations for the season at Medicine Hat, and reached Ottawa on January 2, 1914.

APPENDIX No. 40.

ABSTRACT OF THE REPORT OF R. NEELANDS, D.L.S.

STADIA SURVEYS IN CENTRAL SASKATCHEWAN.

My work during the past season consisted of the stadia survey of lakes in the Humboldt and Prince Albert districts of Saskatchewan and was carried on in the following townships, all west of the second meridian: township 40, range 18; township 44, range 22; townships 38, 39, 40, 41 and 42, range 23, townships 39, 40, 41, 42, 43 and 44, range 24; townships 39, 40, 41 and 42, range 25; townships 40 and 41, range 26; township 46, range 28, and township 49, range 26. In the last named township a stadia traverse was made of the north bank of Saskatchewan river.

In this district there are many small lakes that had not been surveyed; these, as well as the larger ones that had been traversed when the townships were subdivided, were surveyed by means of stadia traverses.

The large number of these lakes is due to the frequency of enclosed basin-like hollows and depressions in a rolling country with few creeks and rivers and an almost level watershed. Few of these lakes have running inlets except in the spring or after heavy rains and fewer still have any outlets. They are subject to great variations in depth and area depending partly on the amount of precipitation, partly on the drainage effected by the cultivation of the soil and the clearing of the land, and sometimes on changes in underground drainage systems, on springs drying in some places and appearing in others, and on natural drains becoming obstructed or diverted.

The water is generally alkaline and often salty. The salt water is caused presumably by the absorption of salts from the soil, followed by excessive evaporation, but the reason why some lakes should be salt and others fresh is not easily explained. Lakes are often salty where there is no indication of alkaline salts in the surrounding country. Lakes with running inlets and outlets are salty and others with no inlets or outlets are fresh while fresh and salt water lakes often lie close together.

Some of these lakes that are connected with Carrot river contain sucker, a species of the catostomidae but otherwise they have no fish. It is probable that some of the deeper fresh-water lakes could be successfully stocked.

In all of these townships the surface is rolling and covered with poplar bush with stretches of open or scrubby prairie. The poplar has been burnt and cut over till what is left is small, and though the growth is dense in places, the land is easily cleared as the poplar stumps soon rot, especially if cut in summer. When cleared, it is fine farming land and does not seem to be so susceptible to frost as the open prairie land. Homesteads in solid bush are now being eagerly taken up but there are still good homesteads left all through this district and good land for sale on easy terms.

The roads are fairly good considering that few of the settlers have been on the land more than ten years and that the district is still only partially settled. The greatest natural difficulty in road building is that the levelness of the country makes it hard to get good drains. The settlers realize the importance of good main roads and wisely confine their work to two or three of the road allowances in the township. The old trails, where still open, make fine roads.

More railways are needed in this district, many farmers have to haul wheat from twenty to thirty miles to market. This takes away their profits and discourages them from making improvements or increasing the area under cultivation.

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The settlers as a whole are making splendid progress. The majority of them have had previous experience in farming in the older provinces or in the States. Agriculture is the sole industry and grain growing is the only branch of it to which much attention is paid. The soil is good and all grain crops do well. The yield and quality are excellent.

The land is still fairly clean but the settlers hardly appreciate the necessity of making a determined and concentrated effort to keep out noxious weeds. All of the settlers keep some cattle, pigs and poultry. Around Reynaud and Bonne Madone sheep are kept for their wool, which the settlers there card and spin into yarn. There too the settlers keep bands of horses and droves of pigs. The Galicians prefer cattle raising to wheat growing and keep the greater part of their homesteads for pasture. The high price of horses has made it impossible for many of the settlers to buy them and oxen are largely used, especially by the Hungarians and Galicians. The decline in the price of horses this fall, however, has extended their use. Many settlers are ignorant of the proper care of horses and of their treatment when sick, and their losses in horses have been costly. The settlers need education too with regard to the comparative values of well-bred and scrub stock and to the wastefulness of pasturing cattle on uncultivated land.

Muskrats are the only fur-bearing animals left which are at all plentiful. Many settlers increase their winter income by trapping them. Bears are occasionally seen but coyotes are not so common as on the open prairie. Deer, elk and moose are still found and moose ranged this fall as far south as township 40 in ranges 23 and 24. Grouse, ducks, geese and cranes are plentiful.

Many Europeans or their descendants have settled in these townships. South of township 42 most of the settlers are Germans or Hungarians. Around Bonne Madone and Reynaud and in township 44, range 22, there are a number of French settlers. There is a Norwegian settlement in township 40, range 18, and township 43, range 24, is settled by Galicians. While they have different standards of comfort and prosperity the settlers get along well together; they all seem to be contented with their homesteads and prospects, while they, at the same time, appear ambitious to improve them. They are well supplied with churches and schools, are comfortably situated, live well and are making as good progress as could be expected. The prospects for the future of this district are the best.

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APPENDIX No. 41.

REPORT OF P. E. PALMER, D.L.S.

SUBDIVISION ALONG THE HUDSON BAY BRANCH OF THE CANADIAN NORTHERN RAILWAY IN
EASTERN SASKATCHEWAN.

St. JOHN, N.B., May 12, 1914.

E. DEVILLE, Esq., LL. D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report on my survey operations for the season of 1913-1914.

We left Prince Albert, the place of organization on June 2, 1913, for Hudson Bay Junction, which was my post office and base of supplies during the whole season.

Hudson Bay Junction is a busy little town situated in township 45, range 3, west of the second meridian at the junction of the Hudson and Prince Albert branches of the Canadian Northern railway. It has two stores and two hotels, and is the centre of the logging operations of the Red Deer and Ruby Lake Lumber companies, who together employ from 1,000 to 1,500 men in the woods during the winter. It is also a railway divisional point, and upon the completion of the line to Hudson bay it will probably have a large increase of business and population. There is very little agricultural land in the vicinity, though within the last few years a number of homesteads have been taken up, and potatoes and other vegetables as well as oats, hay and dairy products, are produced to some extent.

About three miles south of Hudson Bay Junction surveys have been made on Red Deer river with a view to developing power to be used in the manufacture of pulp. If this industry is established it will employ a large number of men and make a profitable use of large quantities of poplar and other wood, which is not suitable for the best grade of lumber.

There is also the village of Ruby Lake in section 10, township 46, range 3, west of the second meridian, on the Canadian Northern railway, six miles north from the "Junction". It has a normal population of about two hundred people, employees of the Ruby Lake Lumber company and their families and has a general store, a post office and mills.

Although the railway from Hudson Bay Junction to Pas has been completed for about seven years, a regular service has only recently been inaugurated, and it still leaves much to be desired. During the summer of 1913, however, many improvements were made to the road, to enable it to stand the heavy traffic occasioned by the building of the Hudson Bay railway.

My surveys extended along this railway from the north boundary of township 45, range 3, west of the second meridian at mileage 5 from Hudson Bay Junction, to the east outline of township 52, range 29 west of the principal meridian at mileage 58.

I commenced my operations by running the east outline of townships 45 and 46, range 2, which I reached by canoe on Red Deer river from Erwood, a station on the Canadian Northern railway, eight miles east of Hudson Bay Junction. I transported my outfit along this line by back-packing. I then moved to Chemong in township 49, range 1, on the Hudson Bay branch of the Canadian Northern railway. From there I moved my camp by push car along the railway as the work required, cutting toboggan trails from the right of way to reach the more inaccessible parts as soon as the ground

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had frozen sufficiently to carry horses. I established the east outline of townships 47, 48 and 49, range 2, by back-packing a small outfit along the part north of the railway, while I reached the part south of the track by toboggan trail cut from where it crosses the north boundary of township 47, range 2, to Leaf lake. I also cut a trail to run the north boundary of township 47, range 1. The east outline of townships 48 and 47, range 3, I reached by packing in from Chemong along the thirteenth base line. To run the east outline of townships 48 and 47, range 4, I cut a trail from the track near the twelfth correction line approximately to the first named line, thence north to the thirteenth base line thus avoiding many bad ravines and much rough country. From this trail I also ran part of the twelfth correction line. I lost considerable time on the east outlines of townships 48 and 47, ranges 3 and 4, owing to the heavy cutting and the difficulty of reaching them. I did the necessary subdivision in townships 46 and 47, range 3, townships 47 and 48, range 2, townships 48, 49 and 50, range 1, retraced the east outline of township 45, range 3, and resurveyed the east outline of township 46, range 3, all west of the second meridian.

This work kept me busy until December 27, when I moved my outfit to Chemong and from there to Otosquen in township 50, range 32, west of the principal meridian, running the east outline of townships 49 and 50, range 32, from those places. At Otosquen I did some subdivision in township 50, range 31, and from there moved to Cantyre, near the northeast corner of township 50, range 31. From there I cut a trail south to the thirteenth base and north to the fourteenth base line to run the east outlines of townships 49, 50, 51 and 52, range 31. I then moved to the east outline of range 30 and cut a trail to the thirteenth base line to enable me to run the east outline of townships 49 and 50, range 30. I also did subdivision in township 51, range 30, from this camp, and established the thirteenth correction line in this range. I then moved to township 52, range 29, and did some subdivision. Finally I moved back to Cantyre, from which camp I established the thirteenth correction line in range 31 and did subdivision in townships 50, ranges 30 and 31, and in township 51, range 30.

The country traversed by the railway between the limits of my work is for the most part muskeg. The soil of these muskegs is usually a fibrous peat, formed by the decomposition of peat litter moss (*Sphagnum Fuscum* Von Galleseu), cup-moss (*Polytricum Juniperium*), Labrador Tea (*Ledrum Latifolium*), and spruce and tamarack trees; it is from three to twelve feet in depth over clay or gumbo subsoil. These muskegs are usually covered with a light growth of black spruce and tamarack from three to eight inches in diameter, the growth of which is very slow. Along the banks of creeks and where natural drainage exists to carry off the surplus water, the soil is usually clay or clay loam and is covered with a heavy growth of spruce and poplar, much of which is suitable for lumber and pulp. The growth of timber in this locality where suitable drainage exists, is very rapid, and when the land is cleared it will be suitable for growing vegetables, hay and the hardier grains. Along the railway, where there is some drainage, I have noticed grass growing in places where the covering of moss has been removed.

Most of the muskegs in this section could be drained, as the surface is usually slightly undulating. These muskegs freeze to a depth of about two or three feet in winter, and the frost remains in them until the first of August. There is an opportunity for the development of a peat fuel industry in this locality, and at the present prices of coal in the West, this would appear to be a subject worthy of investigation.

In connection with these muskegs, which at present seem almost worthless, I would like to call attention to the fact that the Government of the United States has imported into Alaska a number of Lapland and Siberian reindeer animals closely related to our caribou, whose food is moss, and whose natural habitat is muskeg and tundra. These animals thrive to such an extent in Alaska that there are now 42,000 of them. They have also been introduced into Labrador by Dr. Grenfell. There are

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enormous tracts of land in our Canadian West and more particularly in the locality of my work this year, that would make suitable ranges for these animals. The flesh of the reindeer is said to be excellent food, while its hide and horns are also valuable.

The Pasquia hills run parallel to and at a distance of three to six miles from the railway from mile 12 to mile 35. These hills are about four hundred feet above the general level of the country. The outer slopes are covered with a thick growth of poplar and birch, with some spruce and jackpine, much of which is suitable for lumber or pulp, while the higher benches have mostly been burned over thirty or forty years ago, and are covered with a second growth of jackpine, spruce and poplar. There is also a great deal of muskeg in places, covered with spruce up to ten inches in diameter. The soil in these hills is usually clay or loam, and is frequently stony. Many creeks rise there, flowing through deep ravines. On the eastern slopes, where my work was situated, these creeks all spread out to form a swamp at a distance of five or six miles from the hills and again emerge as tributaries of Pasquia and Overflowing rivers. For the most part the land in these hills is not suitable for agriculture, and with the exception of the timber on the slopes, there is, through the locality where my work was situated, very little milling timber. The lower slopes and southern extremity might be suitable for mixed farming, but are not likely to be settled for many years. These hills were explored during the summer of 1913 by the Forestry Branch for the purpose of learning if the district were suitable for a forest reserve. It would appear that this country would be more suitable for that than for any other purpose.

Pasquia river rises in the Pasquia hills and runs through township 49, range 1, west of the second meridian, and through townships 49, ranges 32 and 31, townships 49, 50 and 51, range 30, and township 50, range 29, and thence on toward Saskatchewan river. It varies in width from forty-five feet in township 49, range 1, to ninety or one hundred feet in township 51, range 30, with a current of from one to three miles per hour. It is navigable for canoes in most places east of the second meridian. There is good timber along its course in township 49, range 1. The water is good.

Overflowing river rises in the Pasquia hills and runs through townships 47 and 46, range 3, and township 46, range 2, west of the second meridian, into Leaf lake, thence towards the northeast, crossing the thirteenth base line near the east boundary of range 30, west of the principal meridian, at which point it is about one hundred feet in width and from two to four feet deep, and is navigable for canoes and small boats. There is much good poplar up to twenty-four inches in diameter along the banks, and in many places there are hay marshes and meadows which would afford plentiful pasturage for cattle. The water is good.

Leaf lake is crossed by the twelfth correction line on the east outline of range 2, west of the second meridian. It is about four and a half miles long by three miles wide and from three to ten feet in depth. The shores are marshy and clumps of reeds rise from the water in many places. It is the resort of large numbers of ducks and geese. The water is sweet and good in this lake.

Ruby lake lies in township 46, range 3, west of the second meridian and is about two and a half miles long and from one-quarter to one-half mile wide. It has no tributaries nor outlets and the water is strongly alkaline and unfit for use. The mill and plant of the Ruby Lake Lumber company are at the south end of the lake, around which their limits lie. The shores are marshy on the west, south and north sides, but mostly dry with a good beach on the east. It varies in depth from three to twelve feet.

Red Deer river runs through the southerly part of township 45, range 2, in an easterly direction. It is from four to eight feet deep, with a swift current, has many rapids and is navigable for boats and canoes. There is much good land along its banks and large quantities of poplar and spruce suitable for lumber. It is used by the Red Deer Lumber company for driving their logs.

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Besides the Ruby Lake mills the MacKenzie & Mann Lumber Co. have a mill at Chemong in township 48, range 1, and limits in townships 48 and 49, ranges 1 and 2. The Great West Lumber company have limits in townships 49 and 50, ranges 1 and 2. Ties were cut on permit in several places along the line during the past winter and there is still much good timber in this locality.

. There are no minerals of economic value in this district. Game is very abundant. Moose and caribou are plentiful everywhere and black and cinnamon bears, deer and elk are found in many places, while partridges, ruffed grouse, prairie-chickens, pin-nated grouse and ptarmigan are constantly seen. Geese and the many varieties of ducks are found in the lakes, and the fur-bearing animals, such as muskrats, mink, ermine, otter, lynx, foxes and marten are plentiful enough to amply repay the labour of the trapper. Timber wolves are occasionally met with in the winter. There are jackfish, pickerel and gold-eye in Red Deer river and Leaf lake.

The climate appears similar to that of other parts of Saskatchewan in the same latitude. There is considerable rain in the summer and fall. The first frost occurred about August 20 and the lakes froze over about November 1, but there was very little frost in the ground before the end of December. The snowfall was light only about six inches before February 1, and not more than fifteen inches altogether. The weather during the winter was remarkably fine, only one day being lost from work on account of storm between the 1st November and the 16th of March. The lowest point registered by the thermometer during the winter was 51 degrees below zero. Survey operations can be carried on more quickly and economically in this district during the winter than at any other time.

I completed the work for which I had been given instructions on March 13, 1914 and on the 16th I paid off my party stored my outfit at Hudson Bay Junction and left for the east.

I have the honour to be, Sir,

Your obedient servant,

P. E. PALMER. D.I.S.

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APPENDIX No. 42.

ABSTRACT OF THE REPORT OF T. H. PLUNKETT, D.L.S.

BASE LINE SURVEYS IN NORTHERN MANITOBA.

My work during the latter part of the summer of 1913 and the following winter consisted of the survey of the thirteenth and fourteenth base lines from range 28 west of the principal meridian easterly to lake Winnipeg.

I organized my party in Winnipeg and obtained supplies at Winnipegosis; we left this latter place by boat on August 24. Our progress north on Lake Winnipegosis was very slow. North and west gales which had delayed us two days at Winnipegosis continued to hamper us. On August 29 we arrived at the mouth of Overflowing river with our boat leaking badly from having run on a submerged reef in the lake, thereby damaging most of our supplies.

From information I had previously gathered regarding Overflowing river I believed it easily navigable for canoes and small boats. This I found only partly correct. For a distance of about five miles up the river from its mouth, this stream is very shallow and consists of a series of rapids. Loaded canoes had to be pulled up the centre. After the rapids are passed the river is easily navigable for many miles for small boats and launches.

From my ranger, I learned that we could reach the commencement of our work by following the south branch of Overflowing river, a stream not hitherto shown on maps of the country. Accordingly we left the greater part of our outfit at the point where it was expected the base line would cross the main river and canoed up the south branch reaching a point only two miles east of the point of commencement of our work.

On September 3 work was commenced on the thirteenth base line. Many difficulties had to be contended with in range 27. Throughout the range the line crossed an almost continuous floating bog, so soft and wet that it was with great difficulty crossed by the members of my party. This bog is almost level and I doubt very much if it can be drained. The south branch of Overflowing river meanders through this country from its source, a short distance north of Red Deer lake. I believe this river has an underground connection with Red Deer lake, as it rises most abruptly, in the midst of a huge floating bog. The river appears to be well named as at high water it floods the country for miles north and west of range 27. This branch crosses the base line in section 32. It has low banks, a sluggish current, a mud bottom and a depth of eight feet.

In section 31 of range 26 the line crosses the main branch of Overflowing river, just above the series of rapids leading to its mouth. From there south along the river there are some fine locations for settlers particularly on the northerly side of the river. High land, wooded chiefly with small poplar and willow extends back on an average of from one half to one mile from the river bank. North of this strip of high land the level muskeg extending northward to the base line could be easily drained and I believe those portions of ranges 26 and 25, township 48 lying between the base line and lake Winnipegosis would afford good locations for a few settlers.

North of the base line in the southerly halves of townships 49 ranges 25 and 26 a few good patches of high land were seen, wooded with small poplar and willow, but the extent of these patches was very limited. The northerly halves of these townships as well as township 50 in the same ranges consist of floating bog, undoubtedly flooded

at high water by Overflowing river. Toward the easterly limit of range 25 we began to cross a series of ridges running about due north and south. These are wooded with jackpine with a sand or gravel soil on stratified limestone. Frequent outcroppings of the rock occur. The land seems too barren to be of agricultural value. Between the ridges are floating bogs sloping toward lake Winnipegosis. These could be drained and made productive. This succession of ridges and bogs continues to the middle of range 24 where the ridges disappear and moss muskeg with a scattering of large bogs characterize the remainder of the range.

On October 2 the line had reached the northeast corner of range 24. As navigation on the north end of lake Winnipegosis closes on October 8 it was decided to discontinue work on the thirteenth base, go south to Winnipegosis and on the way down to mound portions of the twelfth base. Previous to our leaving, a cache was built on the thirteenth base to be stocked with provisions for the winter work. We reached Winnipegosis on the night of October 15. The lake froze over on the 24th.

On October 20 the party arrived at Whithorn siding on the Hudson Bay branch of the Canadian Northern railway. Preparations were at once made to complete the mounding and levelling on the fourteenth base line in ranges 28, 29, 30 and 31 which had been left unfinished the previous season. Some difficulty was experienced on this work owing to the very soft and wet nature of the country to be crossed. Man-packing was our only mode of transportation until November 3 when ice on the rivers could be used, but the almost total lack of snow greatly hampered our work. By November 6 this work was finished, and the party was now occupied in moving supplies east in order to continue the survey of the fourteenth base line to lake Winnipeg. Supplies had to be dragged over almost bare ground and consequently progress was slow.

On November 17 the line was commenced at the northeast corner of range 28 and carried on continuously thereafter as far as range 16. Until Christmas the lack of snow greatly hampered our progress and the ill effects of the rough trails on our dogs were felt throughout the winter. On December 16 Saskatchewan river was crossed in section 35, township 52, range 23.

The country between range 27 on this base line and lake Winnipeg in range 11 can best be described in three sections. The first division takes in ranges 26, 25 and 24, the second includes ranges 23, 22, 21, 20 and 19 as far east as Cedar lake and the third extends from Cedar lake to lake Winnipeg.

In the first section the line traversed a country fairly thickly wooded with spruce, tamarack and jackpine, not sufficiently large for milling, and for much the greater part, too small and stunted to be of any commercial value. Ranges 27 and 26 produce mainly spruce and tamarack from six to ten inches in diameter. In ranges 25 and 24 jackpine predominates. As a rule the jackpine was very small and dense. The whole surface of the country in this division is covered with moss from one to two feet in depth. Patches of bog are found on all sides, but these are generally small. When drained this section of the country might be of value for farming.

The second section might be called the Saskatchewan river section. Excepting a very narrow strip of land along the banks of the maze of rivers and lakes found there the country is a continuous bog. Rushes, reeds and rat houses are the common characteristics. It appears to be a flooded country, absolutely useless in its present condition from an agricultural viewpoint. It would require a much more extended study of this section than it was possible for us to give it to predict what possibility there is of its being drained.

Crossing Cedar lake we found in the third division an altogether different type of country. Ranges 18, 17, 16, 15, 14 and 13 are mainly rolling and of a rock formation. In ranges 16, 15, 14 and 13 the flat limestone lies either on the immediate surface or a few inches beneath.

This is a continuous bush country producing jackpine almost entirely. Ranges 13 and 14 have been fire swept leaving for miles on either side of the base line a vast

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extent of bare limestone rock piled up with small brulé. The jackpine seldom attain a diameter of more than six inches. They appear to die for lack of soil.

Throughout this section for many miles both north and south of the line there are innumerable lakes of varying size. Almost all of these lakes have high rocky banks and gravel bottoms. The water is very clear and apparently pure. Clearwater lake in range 17 is one of the largest of these lakes. Whitefish and jackfish abound in it. Jackfish is found in almost all of the lakes. So numerous are these lakes that Indians from Moose Lake and Grand Rapids reserves are able to travel by canoe in almost any direction by making short portages.

In range 12 the elevation drops rapidly in a series of steep hills and narrow gravel benches probably old shore lines of lake Winnipeg. Throughout the greater part of this range however and through section 31 of range 11 where the base line reaches lake Winnipeg we traversed a bog and muskeg country wooded with stunted spruce and tamarack with occasional patches of jackpine. This strip of muskeg extends all along the lake shore, retaining a width of about six miles almost as far south as Grand Rapids settlement. About four miles north of the base line it becomes wider and extends northwesterly. This land undoubtedly could be easily drained and from an agricultural standpoint constitutes the only hope of this third section.

Work was carried on continuously on this base line from November 17, 1913, until February 3, 1914 when the line had been carried as far as range 16. A return was then made to the thirteenth base line in range 24 where the line had been left the previous fall.

From February until April we were occupied extending this line across ranges 23 to 14 inclusive.

From range 23 to the northeast corner of section 31, range 20, where the line intersects the shore of Cedar lake the country is wholly muskeg. The ground is covered with moss from one to two feet deep. Small floating bogs occur. The timber consists of stunted spruce and tamarack. Occasional bluffs were found with spruce up to ten inches in diameter but the quantity of timber is very limited. In the event of settlement this spruce would probably supply settlers with building timber.

In section 23, range 22, Mossy creek was crossed. This creek is about sixty feet wide, three feet deep and flows southeast with a sluggish current to lake Winnipegosis. Along the banks of this creek on a narrow strip of land spruce trees up to twelve inches in diameter are found. Larger timber consisting of spruce, poplar, birch and tamarack is found along the base line throughout range 22 and the western half of range 21. This larger timber however is not characteristic of the country and is found here only because of the proximity to lake Winnipegosis which lies about one mile south. North from the base line to Saskatchewan river the country is of the usual muskeg variety dotted with floating bogs. In this country the scrub spruce and tamarack is supplemented by a scattering of scrub cedar. Between the base line and lake Winnipegosis a very limited number of settlers could be accommodated without extensive drainage being necessary.

The easterly half of ranges 21 and 20 as far as Cedar lake is low wet muskeg of the usual type.

Cedar lake extends across ranges 20, 19, 18, 17 and range 16 as far as section 35.

From there to Saskatchewan river in section 33 of range 15 the line crosses a rocky country. The timber consists of spruce, tamarack and jackpine generally small but attaining in places a diameter of twelve inches. South of the line as one gets farther from Cedar lake the land again assumes the usual moss and muskeg characteristics.

From Saskatchewan river in section 33, range 15, to Cross lake in section 35, range 15, the line crosses a stretch of very fair land wooded with poplar, spruce, tamarack, jackpine and willow brush. This strip extends south of the base line to the river and north of the base line about four miles and would afford a few good locations for settlers.

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The easterly shore of Cross lake is crossed in section 31 of range 14 and from there on to lake Winnipeg the base line runs parallel to Saskatchewan river. This country is underlaid with limestone and frequent outcroppings of the rock occur. The soil is very poor. South of the base line to the river and extending north of the line an average distance of about one mile, there lies a belt of fairly good spruce, jackpine, poplar, birch and tamarack. This timber is easily available at Grand Rapids settlement and may become of value in the future development of this place which I believe has lately been incorporated as a town. In section 34, township 48, range 13, the country drops rapidly and the strip of muskeg along the shore of lake Winnipeg is crossed. This muskeg where the line crosses is only half a mile wide but becomes rapidly wider north of the base line.

The Provincial Government of Manitoba commenced a drainage scheme just west of Grand Rapids this summer with a view to reclaiming this muskeg. It is estimated that about 500 acres will be drained as an experiment. As this muskeg is typical of a vast area of the north country it may be of advantage to intending settlers to describe the methods and implements used in draining it.

The pick and shovel are of secondary importance in this work. The main ditch is first laid out the proper width, usually from six to eight feet, and marked by pickets every hundred feet. One man on either side of the drain then cuts the moss from station to station along the drain with an ordinary hay knife designed originally for cutting hay in the stack. These knives when they are to be used for muskeg ditching should be cut off about six inches below the handles and a piece of iron one foot or so in length depending on the depth of the moss welded in. A third man then cuts the moss across the ditch in strips from one to two feet in width and these strips into squares of eighteen inches or two feet. Following these three men are four others with iron hooks, lifting these squares of moss and muck permeated as they are with small roots which hold the squares together onto the bank of the ditch leaving a berm of two or three feet.

These hooks are manufactured for the purpose from five-eighths inch iron rods. Two rods are fastened together at the handle and also firmly banded together at the bend for the hooks. The hooks are placed at an angle of about thirty degrees with one another. Ordinary manure forks with the prongs turned at right angles to the handle were first used but were found too light to withstand the strain.

Immediately behind these men follow three others with shovels, who level the bottom roughly to grade. It has been found in very wet bogs and muskegs that when the ditch is carried up to a small slough the rush of water will scour the bottom muck out to grade. In some country where old beaver dams are found holding bodies of water it has been found very advantageous to remove only every alternate block of moss before breaking the dam, the resulting rush of water doing the rest of the work.

In the muskeg west of Grand Rapids settlement ten men were able to complete one thousand feet of main ditch in one day. At intervals depending on the level of the ground, but at least every fifteen hundred feet in ordinary muskeg, lateral ditches two or three feet wide are run to the main ditch. As a rule the removal of the moss is all that is required.

This system of drains enables the settlers to use horses or oxen with which to turn under the moss which is undoubtedly the cause of this boggy area. On a very large percentage of this muskeg country the drains need not be made with a view to making them permanent watercourses. There is at present ample slope for natural drainage. All that is needed is sufficiently firm footing for horses or oxen to enable the settler to get rid of the moss. Once this is removed drainage will be no more a problem here than elsewhere.

On April 6, 1914, the thirteenth base line had been surveyed across all lakes. A return was at once made to the fourteenth base line in range 16. Advantage was taken



Drainage Operations West of Grand Rapids, Manitoba.

Photos by F. H. Plummer, D. L. S.

One man goes along each side of the ditch, which is usually about eight feet wide, and cuts the moss with an ordinary hay knife. A third man cuts the moss cross into strips and then into squares, each about eighteen inches or two feet. Four men follow with iron hooks and lift the squares of moss out on the bank and throw them with shovels level the bottom of the ditch roughly to grade. The rush of water carries away all loose muck left in the ditch.

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of the ice and snow to reach range 16 and distribute provisions easterly in three caches to lake Winnipeg. We were just able to accomplish this before the spring break-up came. The work from range 16 to lake Winnipeg was carried on with man-packing as our means of transport.

The base line having been completed block outlines were run south along the east boundaries of townships 52 and 51, range 13, and the party then returned to Grand Rapids by canoe, our boats having arrived from Pas by the first open water. The thirteenth base line was then extended to lake Winnipeg and block outlines run north to the northeast corner of township 50 range 13. After the completion of the base lines and the adjoining block outlines tie lines were run to Grand Rapids settlement and Indian reserve.

By July 1 our work was completed. On the 4th we left by tug for Black river where we connected with the steamship *Wolverine* for Selkirk, Manitoba. The party was paid off at Winnipeg on July 6. The country traversed by these two base lines abounds in game. Moose and caribou are very plentiful throughout the whole country between the second meridian and lake Winnipeg. Scarcely a day passed without these animals being seen by members of the party. East of Cedar lake bears, marten and foxes are plentiful. Muskrats are trapped in large numbers by the Indians in the sloughs and bogs that are found on all sides, mink, lynx, weasel and otter are also taken in large numbers but beaver are rare. Small game such as ducks, geese and grouse of all kinds including ptarmigan is very plentiful.

No valuable minerals were found by the party but claims of red ochre were staked at Cross lake this spring by prospectors from Grand Rapids. The quality seems to be good but as yet it has not been found in sufficiently large deposits to be of commercial value. Samples of what appeared to be potters clay were also brought from Cross lake. East of Cross lake splendid limestone in thick strata is found throughout the country.

Fishing and fur-trading are the only industries flourishing in this country. Extensive operations are carried on on lake Winnipeg, lake Winnipegosis, Moose and Cedar lakes and on Saskatchewan river. The most valuable fish taken are whitefish. Owing to the heavy freight rates from the north end of lake Winnipeg whitefish only are taken. On lake Winnipegosis however, jackfish or pike, gold eye, pickerel and even sucker are freighted to the railway at Mafeking. The winter fishing offers wide opportunities to settlers and during some seasons summer fishing is permitted.

Excepting a few small gardens at Grand Rapids settlement no attempts have as yet been made to cultivate the soil. Potatoes and all other garden vegetables are grown successfully at the settlement.

The early fall of 1913 was very cold. The thermometer dropped to 10° below zero on October 19. After that the weather became milder and no cold weather occurred until nearly Christmas. The winter until February was mild. During that month however, the temperature dropped as low as 58° below zero. Three weeks of very severe weather extended from February 1 to 21.

The spring of 1914 was late, snow remained in the bush until the last of April and the ice on the lakes could be travelled on well into May.

It was June 1 before there were any signs of growth in the bush. Frost at night was noticed as late as June 25. Residents of the country considered this a very late spring.

As a rule the flow in rivers crossed by our lines was slow. No water-powers were noted excepting Grand rapids on Saskatchewan river at Grand Rapids settlement, and the rapids on Overflowing river near its mouth on lake Winnipegosis.

APPENDIX No. 43.

ABSTRACT OF THE REPORT OF R. C. PURSER, D.L.S.

MISCELLANEOUS SURVEYS IN MANITOBA, SASKATCHEWAN AND ALBERTA.

The surveys on which I was engaged during the season of 1913 were quite similar in their character to those I had been on during the previous year. They consisted of scattered miscellaneous surveys of every nature extending throughout the more northerly parts of Manitoba, Saskatchewan and Alberta. The greater part of my work lay in the province of Saskatchewan, and so I found it convenient to use Saskatoon as a sort of headquarters during the season. My party consisted of one assistant and myself supplemented when and where necessary by local labour. In all, thirty-one different surveys and investigations were made, my time spent in field work extending from April 23, 1913, to January 24, 1914, making an average of about one survey per week. A considerable part of the time was spent in travelling from one place of work to another, both by train and by wagon or democrat, our total mileage for the former being over seven thousand one hundred miles, exclusive of our initial and final trips to and from the West, and for the latter over eight hundred miles. We had no transport outfit of our own, hiring the same whenever necessary the advantage of this arrangement being the ease with which we could move from one part of the country to another by train, shipping our small outfit with us as baggage. Most of the surveys on which we were engaged were small, some requiring not more than one actual working day for their completion. A rough classification of the surveys made during the season would be as follows: Eleven retracements for the purpose of correcting monuments out of place or duplicate monuments; five investigations of the condition of monuments; eleven lake traverses; two investigations of lakes supposed to be dried up; one river traverse, and one investigation of timber berth lines.

The retracements first mentioned were mostly for the purpose of correcting small errors in localities where they had been petitioned for by the settlers affected.

Some of the lake traverses above mentioned were held over until cold weather had set in and the lakes had frozen up. Working over the ice did away with a great deal of line cutting which we otherwise would have had to do. In the eastern part of the province of Saskatchewan, particularly in the vicinity of Yorkton, the lakes and sloughs were all found to be filled with water to a much greater extent than they had been for years.

I traversed the left bank of Saskatchewan river through township 33, range 6, west of the third meridian. This work was done in September and owing to the almost impenetrable brush through which our traverse lines had to be cut, it lasted well over three weeks.

In township 55, range 5, west of the third meridian, a fruitless search was made for a timber berth block supposed to exist there. In reality the block did exist some twenty-four miles farther south, the discrepancy being due to a confusion of the neighbouring timber berth numbers on the original surveyor's blue prints.

In addition to the surveys above mentioned we were required to take observations for the determination of the magnetic dip and total force, whenever we could do so without interfering with our regular work. In all forty-eight sets of these observations were taken, the instrument stations here extending through a wide range of territory. At the beginning and the end of the season the instrumental constants were determined at the Magnetic Observatory at Agincourt, Ontario.

APPENDIX No. 44.

ABSTRACT OF THE REPORT OF C. RINFRET, D.L.S.

STADIA SURVEYS IN SOUTHERN SASKATCHEWAN.

I left Montreal on May 2, 1913, for Maple Creek, Sask., where I organized my party.

I then moved by trail via Swift Current to township 6, range 27, west of the second meridian, and began the traverse of Willowbunch lake on May 30.

During the month of June we traversed Willowbunch lake and the lakes in township 5, range 24, townships 6, ranges 24 and 25, and townships 7, ranges 24, 25 and 26, west of the second meridian. The part of the country northeast of Willowbunch lake is well settled and partly cultivated, yielding good crops of wheat, flax and oats. The part southwest is cut up by coulees, but has some fairly level spots so that mixed farming and ranching is carried on successfully.

The lakes in township 6, range 29, were next traversed. The country south of Montague lake is hilly and partly covered with poplar and brush.

We then proceeded to survey Fife lake and the surrounding lakes in townships 3 and 4, ranges 29 and 30. The country north and east of Fife lake is excellent for farming and is fairly well settled, although there are still a few vacant homesteads. The country south and west is hilly, but has many level spots where farming and ranching is carried on. The district around this lake is in my opinion the most suitable one for settlers seen during the season.

Our next work was in townships 4 and 5, ranges 27 and 28, and in townships 3 and 4, range 26. All of this country is rolling to hilly and farmers and ranchers are equally successful.

We then traversed the lakes in townships 3, 4 and 5, range 23, townships 5 and 6, range 24, and townships 5 and 6, range 22. Farming is the principal industry in these townships, all of the suitable land being taken up.

The traverse of Big Muddy lake was our next work. The country south of this lake is very hilly and does not seem to be settled, although ranching would be advantageous if communications with the railroads were more convenient. In township 2, range 22, north of the lake, and townships 3, ranges 22 and 23, there are some ranchers and farmers, but many good homesteads are still vacant.

We then moved to township 7, range 19. This township is all taken up and well farmed.

All the bodies of water in townships 3, ranges 20 and 21, townships 4, ranges 20, 21 and 22 and townships 5, ranges 20 and 21, were then traversed. In each of these townships from ten to thirty-five lakes or sloughs were found. These swarm with ducks and muskrats and some settlers make considerable money trapping muskrats. Most of the lakes contain potable water. That country is well adapted for mixed farming and ranching, and could be more thickly populated.

The remainder of the season was spent in investigating two or three townships which had no lakes and in traversing the lakes in townships 6, ranges 21 and 23, townships 7, ranges 20, 21 and 22 and townships 8, ranges 20 and 21. These townships are convenient to railroads and consequently well settled.

As a rule the lakes and sloughs have been drying up for the last few years, but there are a few exceptions, the most noteworthy being Fife lake which is now three feet deeper than it was some years ago. This was the only lake surveyed which has

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an outlet and the only one containing edible fish in sufficient quantities to be caught with nets. Glen lake situated four miles south has completely dried up.

The depth of the lakes and sloughs surveyed was generally about three feet or less, while a few were five to ten feet deep. The deepest one was fourteen feet. Most of the smaller lakes and sloughs contain drinkable water, while the big ones, with the exception of Fife lake, contain alkaline water.

In all the district travelled over, lignite coal is common and in many places it is mined and sold to the surrounding farmers at from one-fourth to one-fifth of the price of the better grades of coal sold in the neighbouring towns.

I closed operations on November 25.

APPENDIX No. 45.

ABSTRACT OF THE REPORT OF E. W. ROBINSON, D.L.S.

MERIDIAN AND BASE LINE SURVEY IN NORTHEASTERN SASKATCHEWAN.

I left Ottawa on August 8, 1912, and proceeded to Prince Albert to complete the survey of the fifteenth base line west of the second meridian. Upon my arrival at Prince Albert I discovered that the season was wet, and after ascertaining definitely that the Candle Lake trail was in an almost impassable condition I decided to leave this line until a later date, as I was anxious to make an early start on the second meridian. I therefore went to Pas and made arrangements for my winter transportation. In the meantime I had a small party mounding on the fifteenth base line east and west of the second meridian.

I decided to use horses and toboggans for the heavy freighting, keeping in the meantime a small number of dog teams for light work and where speed was necessary. Up to this time horses had never proceeded north of Pelican narrows and my venture was looked upon with considerable misgiving by those familiar with northern travel, but I am pleased to state that I found them a perfect success. When north of Churchill river my horses were inspected by a number of the Indians with curiosity, for they had never previously seen any, and one was surprised to find that they had no horns. I used the horses up to March 28 which was the latest date I could keep them so as to enable them to reach Pas before the break-up. From this date I used the dog trains until the snow went which unfortunately occurred a few days later. I was then obliged to resort to man-packing for the rest of the trip, except on large lakes where the dogs assisted. This early disappearance of the snow is exceptional in this latitude. We had considerable cold weather after that but never enough snow to enable us to use the dogs for overland transportation.

Previous to my experiment the dog train had been relied upon for all northern winter transportation, but when a survey is undertaken at this distance from railways the number required even when one has a cache of provisions reasonably close to the work, is so large that the transportation becomes unwieldy. The great disadvantage of using dogs lies in the fact that every dog team requires a driver and one team on a good trail will not carry more than 400 pounds and usually less. On the other hand a horse toboggan can be relied upon for 1,600 pounds on a good trail, and the saving of blankets, food and tent accommodation for the extra drivers is very considerable. It is undoubtedly desirable that horses should be tented, but this is not absolutely necessary. Horses of the right stamp, namely of about 1,200 pounds weight and preferably of the broncho strain, will do well if properly blanketed and tied in a sheltered situation. Heavy feeding is absolutely necessary to enable them to stand winter work of this description, which is hard on them, and all their ailments should be at once attended to. The heavy mortality amongst horses engaged in winter survey work is largely due to lack of food. It is impossible to expect a horse to work hard on dead grass and a few oats grudgingly handed out. The cost of taking in proper feed may be high but this is preferable to having the party tied up through the collapse of transportation. It seems to be more difficult to ensure against dogs dying. For one reason no general systematic attempt has been made to breed up dogs suitable for work, as is the case with horses. The husky dogs are justly famous for their stamina, but they die sometimes with very little apparent cause. There is no doubt that generally

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speaking dogs are over-driven, and as it does not seriously hurt a well-fed dog to go entirely without food for two days, and thus while working there is a tendency to underfeed especially if the procuring of dog feed entails some trouble. Many dogs will work when completely exhausted and show no sign of their condition particularly to an inexperienced driver while a horse shows signs of fatigue long before exhaustion comes, and he is usually unhitched and taken to camp.

We left Pas to continue the second meridian northerly from township 67, on December 24, 1912, this being the earliest date at which it was safe to leave. The country around Pas is swampy and if heavy frosts do not come before the first snowfall, it is always late before it is safe to travel with horses. We proceeded by the Cumberland House trail and thence to the northeast corner of Beaver lake where some delay was caused by the difficulty in finding a cache. We then travelled up the trail already cut by the men I had sent ahead, and arrived at our starting point on January 10, 1913. The country through which this trail passes is rolling and very rocky in places. It is fairly well timbered with small spruce, tamarack, jackpine and poplar, except where a few small fires have swept through. There are many lakes and the soil is sandy with usually a rocky subsoil.

I commenced running the second meridian on January 13. Through township 68 the meridian crosses low rocky ridges with muskegs between. The soil is sandy with considerable surface rock and is unfit for agriculture. Small spruce, jackpine and tamarack is found and a few small areas of spruce up to ten inches in diameter. Close to the north boundary of section 25 the line enters a lake which forms one of the main routes of travel to the north both in summer and winter. This lake is very irregular in shape consisting of long bays running roughly in a northerly and southerly direction. At the south end a water route leads northwesterly to Wildnest lake and another leads to the east.

Proceeding northerly through township 69 the country becomes rougher. The ridges are broken and rock bluffs are common. The soil is sandy and very rocky and consequently is of no use for agriculture, except in some low-lying sections of small extent where a fair sandy loam is found. Scrub spruce, jackpine and tamarack cover all this area. The lakes are deep with rocky shores and clear water, and are fairly well stocked with whitefish, jackfish, trout and pickerel. Fur-bearing animals seem plentiful particularly foxes and lynx. In section 29, approximately, there is a fall of about twenty-two feet between two lakes which could easily be developed into a power site and smaller falls exist at several other points.

Through township 70 the surface continues broken and rocky. The soil is sandy with considerable surface rock and is useless for agriculture. The timber is a little larger than to the south and the same varieties were seen up to ten inches in diameter. Difficulty of access and smallness of area take away their value for milling purposes. In sections 24 and 25 we crossed a bay of the lake previously mentioned and from the east side of this bay I made a horse trail running to the north end of Wildnest lake. From this point there is a well-known water route leading to Birch portage on the Sturgeon-weir river between Beaver lake and Pelican narrows.

Through township 71 the line crosses only one small lake in section 25. The surface is broken but not so rocky as to the south. The soil is very sandy on the ridges, but in the lower places where it is not muskeg we found a very fair sandy loam. On the top of the ridges there is jackpine up to ten inches in diameter and spruce, tamarack and poplar of the same size on the slopes. West of the line there is a long bay of the lake to the south, and farther west can be seen a high rocky ridge. Fish are not very plentiful there, but fur-bearing animals abound, principally foxes, lynx, mink and otter.

Entering township 72 the line drops to the valley of a lake lying mainly to the east of the line. This lake is shallow and has swampy shores in places. The long bay seen west of the line in township 71 ends here and is connected by creeks and a small

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lake with another lake lying for the most part in township 73. There are rapids on both the connecting creeks suitable for power development. The country through this township is broken but not so rocky as farther south. Jackpine up to six inches covers the tops of the ridges and spruce and occasional patches of poplar and birch are found on the slopes. The land drops generally in a northeasterly direction towards Kipahigan lake lying to the east and northeast.

In township 73 the line crosses two bays of Kipahigan lake. This is one of the prominent lakes of this district, and there is a small Indian settlement on the southeastern corner, at the mouth of a river about two chains wide running southeasterly. There is a water route from this settlement to Kississing lake which lies on the direct route from Cumberland House to Pukkatawagan. There is also another route leading northerly to the Indian settlement on Sisipuk lake which is a bay of Churchill river. Kipahigan lake is well stocked with whitefish, jackfish, pickerel and sucker. The district seems a good one for fur and the residents make large catches of foxes, lynx, mink and otter. On the east side of the lake the country is rough and rocky and a considerable area has been burnt over. West of the lake the surface is not so rough but there are gravel and rocky ridges timbered with small spruce, jackpine and tamarack. There are muskegs between the ridges and small lakes. The soil is sandy with considerable rock.

In township 74 the north bay of Kipahigan lake is crossed. Along the shore there is a narrow fringe of spruce from eight to ten inches in diameter. To the west of the line the country is broken and covered with small jackpine and spruce, and occasional small birch and poplar. The soil is of no use for agriculture, being sand and rocks.

In township 75 a bay of Kipahigan lake stretches to the west and there are many islands carrying spruce and tamarack up to ten inches in diameter. A water route to Pelican narrows leaves the west shore. The line crosses a very rough broken rocky country and precipitous rock bluffs are common. Many of the ridges have been burnt over and are now covered with a growth of small poplar, birch, spruce and jackpine but in other places jackpine up to six inches is found. Many small muskegs occur all through the district. The soil in the depressions between the ridges, where there is no muskeg, is a light sandy loam. Fur is still plentiful, and good catches of foxes, mink, lynx and otter are made every year.

In township 76 the northern extremity of Kipahigan lake is reached and the meridian crosses a number of bays on the east shore. The country is very rocky with precipitous bluffs, and small jackpine, spruce, poplar and birch cover the ridges. The soil is sandy and very rocky except in depressions where there is a fair sandy loam. Fire has burnt over some sections. To the east the country is even more rocky and broken.

In township 77 the meridian crosses several arms of Sisipuk lake, one arm of which runs to the north along the meridian and almost reaches Churchill river, thus forming practically an island. The shores of Sisipuk lake are not so rocky as the shores of the lakes to the south, and they are generally well timbered with spruce, poplar and birch up to eight inches in diameter. The arm stretching in a northeasterly direction forms part of one of the water routes from Pelican narrows to Pukkatawagan, along which there is a considerable amount of travel. The islands are generally well timbered with spruce, tamarack and jackpine up to ten inches in diameter. It was noticed that the islands in all these lakes are usually better timbered than the mainland. The soil also is better, usually a very fair sandy loam, and the Indians living on this lake cultivate small patches on the islands. In section 24 there is an Indian settlement of six houses and both the Hudson's Bay company and Revillon Frères have traders there. A considerable quantity of fur is handled every year, foxes, lynx, beaver, mink, otter, bears and weasels being the principal varieties. All the district is apparently well stocked with fur-bearing animals and every Indian with any energy can make a good catch. The lake is well stocked with whitefish, pickerel, jackfish and sucker. The country

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lying to the west of Sisipuk lake is very rough and rocky and is sparsely covered with scrub spruce and jackpine.

In township 78 the meridian crosses the north end of the west bay of Sisipuk lake. Along the northeastern shore there is a strip of sandy loam covered with spruce, poplar, and birch. The surface is somewhat rolling, but there are several small areas of good agricultural land. Inland in an easterly and northeasterly direction we found a broken and rocky country with small spruce, tamarack, birch and poplar. The soil was sandy and very rocky, and of practically no use for agriculture. To the west of the bay the surface was rolling and timbered with spruce, poplar and birch up to eight inches in diameter with a few swamps and muskegs. The soil is mostly a light sandy loam with patches of a heavy clay loam. Rocky ridges are also in evidence.

In section 1, township 79, we crossed the southern shore of Churchill river. The river during this part of its course is more truly a string of irregularly shaped lakes connected by narrow channels, usually with rapids in them. The shores have a fairly gentle slope back from the water's edge, although it is very rocky in some sections. The banks are well timbered with spruce, poplar and birch up to ten inches in diameter, although most of it is under this size. The islands, of which there are a large number carry better timber of the foregoing varieties. All along both banks of the river, and more particularly on the islands, there are areas of good agricultural land. The soil varies from a sandy loam to a clay loam and is comparatively free from rock. Hay can be cut in swamps at the head of some of the bays, one good place being the bay lying to the east of the line in townships 79 and 80. The river is well stocked with sturgeon, whitefish, jackfish, pickerel, trout and sucker. As a fur country it appears good. All the Indians had good catches of beaver, foxes, mink and otter. There is a small Indian settlement of about five houses east of the meridian at the mouth of Loon river, which enters the Churchill from the north.

In township 80 after leaving Churchill river the land rises to the north and the line crosses an area of rolling land, becoming broken toward the northern part of the township. To the west of the line in the southern part of the township, the country slopes down to a bay of Churchill river but to the east it is high. A creek about sixty links wide was crossed in section 25 running southwesterly to the river. It is very unsuitable for canoe travel owing to numerous obstructions and rapids, but at high water it is passable for small canoes. It receives several small tributaries during its passage from a lake crossed in township 81 to Churchill river, and there are several falls on these which could be utilized for small water-powers. West of this creek the land is broken and cut up by ravines. Spruce up to six inches in diameter, poplar, birch and tamarack cover the slopes with jackpine on the summits of the ridges. The soil is a sandy loam and very rocky. To the east of the creek the land is high carrying spruce, poplar, birch and tamarack up to eight inches in diameter with many swamps and muskegs. The soil varies from a sandy loam to a clay loam and surface rock is usually present.

In township 81 the line crosses a lake. To the east the country is high and rolling covered with small jackpine, spruce, poplar and birch and the soil is sandy and very rocky. To the west we found a broken country with jackpine and spruce up to six inches with some poplar, birch and tamarack. There are some small patches of sandy loam land.

A small lake was crossed in section 1 township 82, and from the northwest corner a portage of about half a mile leads to the south end of a long lake lying to the west of the meridian. To the west of this lake the surface is high, rolling and rocky, covered with small spruce, tamarack, jackpine, poplar and birch and there are many small lakes. The soil is sandy with considerable rock. To the east of the meridian the country is similar with many bare ridges.

In township 83 several small lakes were crossed before reaching the south shore of Kamuchawi lake in section 24. The land on both sides of the meridian is high, roll-

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ing and rocky with many small lakes and is covered with small spruce, tamarack, jackpine, poplar and birch. The soil is sandy with considerable rock, with the exception of fringes around some of the lakes where a fair agricultural soil is found varying from a sandy loam to a light clay loam. Kamuchawi lake is a large body of water lying partly in townships 84 and 85 and on both sides of the meridian. It is deep with clear water and is well stocked with trout, whitefish, pickerel and jackfish. Its shores are well timbered with spruce, jackpine, poplar and birch up to six inches. It is drained from the northeast corner by Loon river. This river constitutes a well known water route. It expands into a number of lakes and in its narrow parts is usually full of rapids; the portages however are good. It reaches the Churchill in township 79 east of the meridian. When it is decided to continue the second meridian farther north, this will be the best way to reach the end of the line in summer from the Churchill. At the northwest of Kamuchawi lake a bay stretches to the west and from this point there is a water route to Reindeer lake. I have been told that there is a lake of considerable size called Rabbit lake situated to the north of Kamuchawi lake. Between Kamuchawi lake and the Loon river the country is very rough and rocky with scrub spruce and jackpine growing thereon.

We finished running the line on May 12. I sent the party back over the line to do the mounding and the levelling to Churchill river while I returned to the main camp in township 81, and started from there with canoe and supplies to go by the Loon river route, to the end of line to get a latitude observation. We had a hard and strenuous trip. The lakes on this route were only partly open. I was able to pick up a jumper and when it was impossible to travel with canoe, we would cut our way through slush ice to where it was fairly solid, and then take the canoe out, place it on the jumper and travel on the ice until it became too rotten to proceed any farther. Then cutting a trench in the ice the canoe would be placed therein and forced into open water. I arrived at the north end of Kamuchawi lake on June 4 and commenced taking latitude observations. This I continued up to the 13th with excellent success. On this day, however, we unfortunately had a bush fire that burnt our camp out. We lost practically all the camp outfit, food, personal belongings, etc., but worst of all some of the records of this survey. The latitude observation records were destroyed and one azimuth observation book and some accounts and field books were partly burnt. I returned at once to the party who by this time had reached the Churchill, and as I had neither the supplies nor the outfit to stay and obtain the missing information I decided to return to Pas. I went to Pukkatawagan to obtain canoemen and an extra canoe. Pukkatawagan is a fairly large Indian reserve situated on a bay of Churchill river. It is a picturesque spot and the land, although light, seems to be productive. I was informed that all the common vegetables can be raised to perfection. The season is short but the rapid growth caused by the long days of summer compensates for this. I obtained the necessary canoemen there and returned to my main camp.

The quantity of land suitable for agriculture in the country traversed by the second meridian between townships 67 and 85 is very limited. The lakes are well stocked with whitefish, jackfish, pickerel and sucker. Fur-bearing animals abound, the principal varieties being foxes, lynx, mink, otter, beaver, bears and weasels. The barren land caribou, in their migration, reach the Churchill in winter and leave about the third week in March. These provide an excellent supply of fresh meat during the winter. The caribou seem to be coming farther south every winter. In summer time moose may be obtained as far north as Churchill river and a few stragglers even farther north. In winter time the moose all migrate to the south. It was reported to me that there are some bush caribou here, but I did not see signs or tracks of any.

On June 21, we started down to Pas travelling by Barrier, Kississing and Cumberland lakes. This is a well travelled route and the portages are fairly well cut. We arrived in Pas on June 30, and I paid off my party on July 1.

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I then had instructions to complete the mounding of the fifteenth base line between the second and the third meridians. The water in Saskatchewan river was very high and I knew that the swamps through which the line passed would be wet, but on July 28 I left Pas for my starting point. I found that the line was impassable and went farther up stream to two other points on the line, but the same conditions prevailed. I accordingly returned to Pas. I again left Pas on August 25 as the water had fallen considerably, and found that it was possible to get through some of the swamps. The work was slow and laborious, but I was able to bring supplies by canoe to several points by the Saskatchewan and Torch rivers, and man-packing was resorted to between these points. From range 10 the canoe work ceased and man-packing was the only method of transportation. A delay was caused by a large floating muskeg which could not be crossed until the surface was frozen. Three dog trains were used when it was possible for them to travel. The work was completed and the party returned to Pas on February 25, 1914. Two men who unfortunately had their feet frozen arrived on March 7.

APPENDIX No. 46.

ABSTRACT OF THE REPORT OF O. ROLFSON, D.L.S.

BASE LINE SURVEYS IN NORTHERN MANITOBA.

My work during the summers of 1912 and 1913 and the intervening winter consisted of the survey of portions of the fifteenth, sixteenth and seventeenth base lines west of the principal meridian.

I organized my party at Selkirk and left for Norway House on June 10, 1912, travelling by the steamer *Wolverine* to Warren's landing, and by the Hudson's Bay company's boat *Highlander*, the remainder of the distance.

Owing to very stormy weather on lake Winnipeg, the barge with my supplies was so delayed that it did not arrive at Norway House until June 18. As soon as it was unloaded I left with canoes travelling up Jack and McLaughlin rivers to the principal meridian and then packed north to the fifteenth base. The following day, June 27, I commenced cutting the line and continued until July 30, it being then completed to Playgreen lake.

As Kiskittogisu and Kiskitto lakes which are crossed by the sixteenth base are too large for triangulation, I moved down to Cross lake and commenced running the seventeenth base. My plan was to run enough of this line in 1912 so that it might be completed as far as necessary the following summer. After running five ranges I left a small party at Cross lake to do some miscellaneous work and moved the main party back to Norway House, from which place we commenced moving supplies to Sea falls to be ready for the winter's work along the sixteenth base.

On October 21 I commenced work on this line and continued it until April 8, 1913, by which time I had run 150 miles. The warm spring weather was then melting the snow so fast that I was compelled to cease work and move into Pas, travelling via Cormorant and Clearwater lakes, and the Hudson Bay railway grade. We moved none too soon as two of the teams broke through the ice on Cormorant lake. At Pas I disbanded the party and made preparations for completing the seventeenth base to Reed lake.

On June 6, I again left Selkirk for Cross lake by the same route as before. On the 18th, I commenced running the seventeenth base and continued until October 2, by which time it was completed to Reed lake in section 36 of range 20. I then moved to Cormorant lake via the regular canoe route and on December 9 completed the sixteenth base to the second meridian. After this I returned to Pas and disbanded the party.

In the summer of 1912 I had all my supplies for the eastern part of the line shipped directly to Norway House and then moved to Playgreen lake and Cross lake as required for the different parts of the work. I also had supplies shipped by boat from Pas to the narrows on Cormorant lake, and placed in cache there for use on the western part of the sixteenth base. In March of 1913 I had supplies for the westerly end of the seventeenth base shipped by the railway contractors by means of horse teams from Pas to camp 7 near Limestone river, and held for me until required in the fall. I shipped supplies for the easterly end of the seventeenth base to Norway House, then took them with my own party to the beginning of the work.

During the latter part of October and until the freeze-up occurs, it is practically impossible to work in the bad swamps because standing all day in ice-cold water is beyond the limit of endurance. When winter sets in there is no more difficulty. Work in this district is both easier and more pleasant in winter than in summer. In the

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spring the party must disband for about two months because during the latter part of April and all of May dog teams cannot be used, and as the lakes are not yet free of ice canoes are useless.

For survey work during the winter only, horses and flat sleighs may be used to advantage for transportation, but a surveyor working all summer must use dog teams the following winter, or disband his party until about Christmas. As a general rule horses cannot be used until late in December, when the swamps are frozen, whereas dogs may be used in bush as soon as snow falls, and on the lakes as soon as they are frozen, generally about November 15. In making trail it is best to have several men walk ahead and return on snow-shoes, cutting what is necessary as they go. This will freeze at night and the next day the dog teams should be sent ahead loaded with heavy and compact supplies, the drivers wearing snow-shoes. This still further packs the snow which freezes at night leaving a good trail for moving the awkward high loads of camp equipage and dunnage. Before it is frozen, no one should be allowed on the trail without snow-shoes because the holes make hard work for the dogs.

Transportation by dog team is, under certain circumstances, the best method to use but it is always expensive. It requires one man to drive each team which haul about 400 pounds, often much less. On this basis freight moved along the line costs \$1.00 per 100 pounds per seven miles.

Fish is without doubt a splendid dog food as the northern dogs are accustomed to eating it, but it is very inconvenient for use by the base line surveyors. Five working dogs should be fed two fish each day or about thirty pounds, that is eight per cent of the load they can haul. The same dogs will eat ten pounds of dog biscuit per day, that is 2½ per cent of the load they can haul. No matter how carefully he may plan, the surveyor is never certain of getting all the fish he requires, whereas dog biscuit may be purchased from the wholesale firms and shipped to the line along with the rest of the cache. Dogs entirely unused to eating biscuits will soon relish them and keep in good condition. I have never seen biscuits fed to dogs that are making long hard trips every day, but believe they could be successfully used.

I have tried different methods of running line during the summer, but find the most successful is to move camp to the end of the work each morning, then cut line during the day and return to camp at night. In summer the men must be supplied with silk tents in order to lighten their loads. The comforts of life are few; the cook bakes without a stove, using frying pans, the men eat without dishes rather than pack the extra weight and everyone is continually wet, generally to the waist, because of wading through swamps. Man-packing is very laborious, but it the only method possible in the summer. The caches are placed on canoe routes near where the base will cross and the supplies packed along the line until the next route is reached.

Those accustomed to packing with horses have no idea how much of their camp equipage and personal effects may be dispensed with.

There is no comparison between the swamps in the western country where horses are used and those where surveyors attempt to use anything else than men for packing. Last season on the seventeenth base our party ran from Muningwari lake to the grade of the Hudson Bay railway, a distance of nineteen miles, and carried their camp equipment, dunnage and supplies over very bad swamps with no possible way of getting supplies in at any intermediate point. This will, perhaps show how great is the difficulty of summer work in this district.

The country along the fifteenth base from the principal meridian to Playgreen lake is a series of spruce and tamarack swamps with granite outcrops occurring about once or twice in each mile of line. The underlying rock is all granite and the swamps lie in the depressions. There is a small amount of spruce along the banks of McLaughlin river. The soil in most places is a black muck which is unsuited for farming. There are occasional clay ridges covered with poplar and birch, but these are too scattered and small to be of great value.



Shallow Shore of Waskik Lake.

Photo by O. Robinson, D. I. S.

This lake is situated in township 64, range 9, west of the Principal meridian. The shore is very shallow, and the soft muddy bottom prevents even the use of canoes near the shore, unless pushed along through the mud. Though the men appear to be knee-deep in water, there is really not enough to float the canoes, as they are walling in nearly a foot of soft mud.

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The first four miles of the sixteenth base crosses bad tamarack and spruce swamps but near Nelson river the land is drier and covered with spruce, jackpine, birch and poplar. Along the west side of the river the line runs for about two miles through a *brulé* ridge. From range 2 to Playgreen lake the country is spruce and tamarack swamp. Between Playgreen and Kiskittogisu lakes the line runs through a small belt of spruce six to twelve inches in diameter. Between the latter and Kiskitto lakes the country is swampy and covered with small spruce and tamarack.

For the first five miles west of Kiskitto lake the line runs through a mixture of spruce ridges and tamarack swamps; west of this the swamps are more extensive and the spruce occurs as knolls or islands in the swamp. For a short distance on each side of Minago river the country is burned and covered with deep windfall. From there to the beginning of range 14 it is almost all swamp. About the middle of range 14 the line runs through spruce and jackpine; a rock outcrop occurs there, the first after leaving Kiskitto lake. West of this the country is drier, the rock is limestone and the timber spruce, birch, poplar and jackpine.

Around the shore of Little Cormorant lake there is considerable limestone, which appears to be of good quality. The soil away from the rock ridges is clay and clay loam.

In the first two miles west of Cormorant lake the line runs over a limestone hill, covered with small jackpine and spruce. Ranges 24 and 25 are covered with spruce and tamarack with frequent jackpine ridges. Small lakes are numerous. In ranges 26 and 27, the line runs through a large amount of clay loam soil covered with spruce, poplar and birch. This is the best land seen along the three bases. It is distant from Pas about fifty miles.

East of Cross lake the seventeenth base runs through spruce swamp. The timber is of little value being the ordinary stunted growth generally seen in wet country. Near Cross lake on both sides and on the island crossed by the line, the underlying rock is granite, the soil clay loam and the timber spruce, birch and poplar from six to fourteen inches in diameter. West of the lake the country becomes softer and wetter and the timber gradually changes to the small spruce and tamarack of the swamps.

In range 9 near Lily lake and from there to Muningwari lake, in range 10, the soil is mostly clay loam and the timber spruce and poplar. On the west side of Muningwari lake extending for one mile east and west and nearly five miles north and south there is a belt of good spruce and jackpine from six to twenty inches in diameter. The soil is sandy, some of it being attracted by the magnet. The remainder of range 10 and ranges 11, 12 and 13 are very wet and covered with small spruce and tamarack. This is the same great swamp that is crossed by the sixteenth base in ranges 12 and 13. Through ranges 14 and 15 the line runs near Limestone river. There the soil is clay loam and the timber growing along both sides of the river is good spruce. In ranges 16, 17 and 18 the line runs through a vast spruce and tamarack swamp. Range 19 is drier being nearer Reed lake. As usual the timber also improves and near the shore good spruce grows from six to eighteen inches in diameter. The underlying rock is again granite and the soil clay loam. The rock at Norway House, Cross lake, Lily lake along Nelson and Muhigan rivers and also at Setting and Reed lakes is granite. The limestone area projects into this from the south.

At Norway House the settlers have small gardens and grow potatoes and some of the ordinary vegetables. One settler at the narrows of Cormorant lake has grown good potatoes and some of the resident engineers along the line of the Hudson Bay railway have small gardens with the ordinary vegetables. When circumstances warrant an extensive system of drainage I believe that some of this district can be used for farming.

Many of the swamps are soft and very difficult to cross in the summer, but nearly all have a hard bottom of clay, sand or rock. In mounding where the moss is thick, ice is frequently found at a depth of twelve inches throughout the summer.

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Partridges, prairie-chickens, ptarmigan, rabbits, rats, mink, caribou, moose and bears are plentiful. In the district near Reed lake the work of beavers is seen along many of the rivers. Large numbers of whitefish, jackfish and some pickerel and gold-eye are found in all the lakes, and large trout in Namew lake. The Indians have no difficulty whatever in obtaining all the fresh meat and fish they require, and making a good living with their traps in winter. Trappers' cabins are numerous on all the lakes and rivers.

When the railway is completed the facilities for transportation will make the fishing industry profitable where now it is carried on only for dog feed in winter and for the local supply in the summer.

On almost all the rivers there are water-powers which will some day be valuable.

The original site of Norway House was on a point north of Warren's landing but many years ago it was moved to its present situation on Norway House island. This is the district office of the Hudson's Bay company for Keewatin district, and is the scene of great activity at times in the summer when freight is arriving or leaving. The Methodist mission is on the mainland northeast of the post; the Roman Catholic mission is on the east side of the island and the English mission is on an island immediately south. There is an Indian village near and many houses are scattered up and down the river.

The Northern Fish company run two boats from Selkirk to Warren's landing at the north end of lake Winnipeg in connection with their fishing operations and the Hudson's Bay company run a boat from there to Norway House. All freight for the district north of lake Winnipeg passes through Warren's landing. From Norway House the regular route to York Factory and intermediate points is via Nelson river, to Echimamish river, then through the lakes and rivers past Oxford House and down Hayes river. The Hudson's Bay company operates a small car on a wooden track over the portage on the Echimamish. The route down the Hayes instead of the Nelson is used because of the number of rapids on the latter. The route to Split lake and Nelson House is down the Nelson from Cross lake. Freight for Oxford House, Split lake and Nelson House is taken in York boats, that for Gods lake and Island lake is sent up Jack and McLaughlin rivers in canoes.

During the summers of 1912 and 1913, most of the freight for Cross Lake post and points north was shipped to Whiskey Jack by boat, then teamed across the portage and sent to Cross Lake post and points north in York boats.

Last summer the contractors for the Hudson Bay railway sent their freight from Warren's landing direct to Whiskey Jack, teamed it across the portage, and then shipped it over Cross lake in a barge towed by a gasoline launch. From there to Sipiwek lake, a distance of thirteen miles, they hauled it on a pole track, and then towed it in another barge across the lake. During the coming summer they will be able to take freight by this means as far north as Manitou rapids. From there to Split lake and points north it will be necessary to use canoes or York boats.

A small steamer runs from Pas up and down Saskatchewan river and across Moose lake to the narrows of Cormorant lake. The most used canoe route to the north from Pas is to Limestone bay on Moose lake, across the portage, ten miles to Limestone lake, then down Limestone river to Grass river and thence into Setting lake.

The Hudson Bay railway now under construction from Pas to Port Nelson crosses the sixteenth base in range 21 and the seventeenth base in range 13. When completed this road will alter and reverse many of the present freight routes into the north.

From Namew (Sturgeon) lake, there is a winter road out to Pas via Rock and Root lakes and the easterly side of Reader lake. This is used by teamsters in hauling fish from Namew and Rock lakes to Pas.

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APPENDIX No. 47.

ABSTRACT OF THE REPORT OF G. P. J. ROY, D.L.S.

SUBDIVISION IN EAST CENTRAL SASKATCHEWAN.

Our work for the season of 1913 lay mostly in the country bordering on the south limit of the Porcupine forest reserve in the eastern part of the province of Saskatchewan.

We left Tisdale on May 28 and on June 6 reached township 41, range 13 west of the second meridian where our first work was situated. On July 24 this survey was completed with the exception of the traverses which were left over for the winter.

The soil in this township is a heavy coat of yellow loam over a clay subsoil. The surface is a succession of light slopes and levels covered with areas of poplar two to five inches in diameter, interspersed with patches of brush and scrub. The principal topographical feature is Barrier lake, a long narrow body of water situated at the bottom of a valley from one hundred to one hundred and fifty feet deep. When cleared this district will be a good farming locality.

From July 25 to August 4 we were absent from our main camp running the boundaries of blocks 1 and 2 of timber berth No. 2055 situated in townships 42 and 43, range 11. We estimated these bluffs to be capable of producing nearly ten million feet of spruce. The spruce bluffs of the berth were surrounded by poplar woods interspersed with scrubby and open spaces. Red Deer river, a swift-flowing stream one hundred feet wide and four to ten feet deep, winds southeasterly through township 42, one bend of it being only half a mile from the south edge of the berth.

On August 5 we proceeded to township 39, range 9 west of the second meridian to survey the portion lying outside of the forest reserve. We found the soil good with large areas of open country interspersed with areas of timber, light poplar and willow brush and a number of small sloughs.

From there we moved to Kelvington where we camped, while the wagons drove to Wadena to haul in supplies coming from Winnipeg. Wadena is a prosperous new town on the branch of the Canadian Northern railway running from Winnipeg to Edmonton.

On September 2 we moved to the northeast corner of section 6, township 37, range 4 west of the second meridian and commenced the survey of the western part of the township. This township contains large sloughs mainly on sections 5, 7 and 8 and the low ground in the vicinity is covered with small poplar, willow and poplar brush, section 6, as well as the northern sections, is good level land, and is covered with a growth of poplar averaging two to three inches in diameter and scattered bluffs of spruce of little value except for homestead purposes. The southern sections are lightly wooded, and have some open spaces. Intending settlers were exploring them when we left.

The part of township 37, range 3 which we surveyed is similar to township 37, range 4, that is to say lightly rolling with the same kind of soil, but the bush is denser. We completed the work there on October 20.

There is a post-office two miles south of the centre of township 37, range 4, and Preeceville, the present terminus of the branch of the Canadian Northern railway running from Swan River, was within one day's travel from any of our camps. The location line of the proposed railway from Corona to Hudson Bay Junction crosses the same township.

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Leaving our camp there on October 21, we camped seven days later on the bush road opened along the east boundary of township 36, range 31, west of the principal meridian where our work consisted of the survey of part of this township, and the north and east boundaries of sections 19 to 24 in township 36, range 30. This work being completed we left for Bowsman on December 9.

Township 36, range 31 is thickly wooded, the only openings being a number of small hay sloughs. Part of the two northern tiers of sections and all of the southern part is a forest of poplar, some measuring up to seven inches, but most of it being from three to five inches in diameter with extensive windfall. Evidences remain of a bush fire which had passed many years ago. The soil is good and the surface slopes slightly to the south.

An old mill site is situated on section 34 in the middle of a well-timbered area which, although partly cut during recent years, is still capable of yielding at least ten million feet of good spruce.

The sections surveyed in township 36, range 30 are all wooded with poplar and scattered bluffs of spruce. The soil is good, the surface level, and there is an abundance of building material, fuel and water.

Benito, a progressive town in township 34, range 29, is the business centre of the vicinity. Arran is the nearest railway station but the village is small and there is no station agent.

The soil in the whole of this district is good and is suitable for all kinds of grain and root crops. With timber, fuel and good water in abundance, and roads good for travel even in their primitive state, it is one of the best sections for intending settlers.

All the small towns are growing fast and constitute a good market for all farm produce as well as for horses from the remaining but fast disappearing ranches.

On December 9, we closed operations for the season and left our camp on section 12, township 36, range 21, west of the principal meridian for Bowsman, where I stored the outfit, paid off the party and left for home.

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APPENDIX No. 48.

ABSTRACT OF THE REPORT OF A. SAINT CYR, D.L.S.

MERIDIAN AND BASE LINE SURVEYS IN NORTHERN SASKATCHEWAN.

My work for the season of 1913-14 consisted of the survey of the third meridian through townships 69 to 72 and the nineteenth base line west of the third meridian to the end of range 17.

I left Prince Albert, where my party was organized, on June 3, 1913, and arrived at "the forks" on the Montreal lake trail five days later. There I divided the party and instructed by first assistant to proceed to the eighteenth base line by the pack trail along the third meridian. Knowing that at many of the camping grounds along this trail the grass would be scanty, I advised him to take as many bags of oats as the horses could possibly carry, in addition to the men's outfit which had been reduced to the bare necessities. They took sufficient provisions to last them three weeks. With four men I proceeded to the Hudson's Bay company's trading post at the south end of Montreal lake, where I had already arranged to build a boat for the transport to the line, of our supplies stored at both ends of this lake. This mode of transportation was the only one possible at that season. The boat was substantially built, special care being given to the bottom. Its dimensions were thirty feet in length, but only eight and one-half feet in width. It had to be built narrow in order to run safely through the worst rapids where the channel is less than ten feet wide, and very tortuous in places. After the boat was built, I experienced some difficulty in securing an Indian crew, the best boatmen being at the time away from the village. Finally this matter was arranged by the agent of the Hudson's Bay company and on June 22 I made a start from the company's trading post at the south end of Montreal lake. The boat had been loaded with six and a half tons of material for the survey, and the crew consisted of four members of my survey party and several Indian canoemen picked up at Montreal lake. Sailing up the lake, I reached the north end on June 25. Loading up two and a half tons more of camp supplies I then proceeded down Montreal river.

On July 1, we reached Montreal rapids where I received news of the main party who had just reached the eighteenth base line and were commencing the survey of the third meridian. They had met with many difficulties on the road owing to the flooded state of the country; the rebuilding of bridges, rebrushing of muskegs and the opening of new trails had considerably delayed their progress. I also learned that one man had quit the party shortly after the start had been made from "the forks" and that two of their ponies had taken sick and had been left behind near a small hay meadow, the packers intending to return for the ponies later on in the season.

At the "rapids" the packers loaded enough supplies to last the party until the big boat should have been brought to a point ahead of the line, whence a pack trail might be constructed along the nineteenth base line.

While going down the "Montreal rapids" a member of the Indian crew had the misfortune to meet with a serious accident and the rest becoming frightened at the difficulties met in navigating this river, decided to return with him to Montreal Lake Indian reserve. Accordingly I sent word to the Hudson's Bay company's agent at Montreal lake to despatch another crew of boatmen and to instruct them to pick up a small lot of supplies which had been left behind along the river banks, at Askik rapids.

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Leaving Montreal rapids, we proceeded north to Sikachu lake which we reached on July 10. Here I spent some time exploring the country in the hope of locating a route passable for loaded pack ponies, but was unsuccessful, the soft and quaky nature of the ground and the extensive tracts of open bogs and treeless swamps upsetting all my plans in this respect.

My party was also experiencing great difficulties in their work and frequently had recourse to man-packing to move their camp outfit and supplies forward and the survey work that was daily carried on was due to the indomitable energy of the first assistant.

While waiting at Sikachu lake for the return of the Indian boatmen who had been sent back to Montreal rapids and Mountain rapids for some supplies that had been left at these places, I began a thorough exploration of the country northwest of the lake. Entering one of its west bays, I followed it two miles. At this distance it turns northwesterly. Noticing a gap through the hills along the west shore, I concluded that it must be the valley of a stream discharging into a bay. This proved to be Morin river which is from two to four chains wide and eight miles long. As the current was slack, we made good progress and soon came to Morin lake nearly five miles long and bearing west. This brought me within five miles of the third meridian but almost eighteen miles north of my party. However, another large stream was discovered flowing from the south into Morin lake and by ascending it five miles I came to Moose lake from which starts a portage leading to Smoothstone river. I returned to the big boat on Sikachu lake for more camp supplies and before leaving again for Moose lake I instructed the two men left in charge to overhaul all our provisions, some of which were in a fair way to spoil, and then to bring the boat to the west shore of Morin lake and there build a cache for our supplies. As the land west of this lake appeared to be fairly high I saw the possibility of opening later on, a pack trail between this cache and the line.

I returned to Moose lake in the old canvas canoe loaded with as many supplies as it could safely carry, and stored these on the west shore of this lake. Moose portage, which crosses the third meridian, begins here. Near this point I had previously left a note and sketch of the surrounding country (as we knew it then) for the explorer; it showed the location of this "cache" of supplies and advised my first assistant of my future whereabouts. On August 6, travelling westerly on Moose portage, I met seven of my men heading for the "cache" so we carried all the supplies to the first lake on the portage. These supplies were, the same night, brought to the main camp in the canvas canoe which one of my men had carried across the portage.

The northern Moose portage had been explored by me with the view of utilizing it for the transport of the supplies to Smoothstone river and thence to Snake lake, close to which we thought the nineteenth base line would run. If this could have been accomplished, it would have been of great assistance to us as my transport outfit was in a very reduced condition, no fewer than nine ponies having contracted swamp fever and an equal number being unfit for work through foot-rot. I was however unable to follow out this plan. Along Moose portage there are too many lakes surrounded by muskegs unfit for travel by horses, and no rafts could have been floated down Smoothstone river which, as we discovered later in the season, is a succession of rapids. Therefore, we frequently resorted to man-packing as our only means of transport.

The southern portage to Smoothstone river was, if possible, in a worse condition than the northern one, as it runs across a succession of quaky bogs and muskegs which do not become fit to travel over with dogs till frost has set in. The main party had up to this point been experiencing much difficulty from the wet country through which they were travelling and their horses were in very poor condition from lack of feed, the only grass obtainable being that growing in deep sloughs in which the horses had to stand in a considerable depth of water with the result that swamp fever and foot-

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rot were prevalent and several animals had already succumbed. Up to that time all medicine given to them to counteract these ailments did not appear to produce the desired effect and no relief could reasonably be expected till the animals had been brought to a higher country.

From Moose portage the country along the line was drier and fairly good progress was made. When the line had reached as far north as Morin lake, seeing no prospect of getting farther west with the big boat, I transferred supplies contained in it to another "cache" which had been built about three miles from a lake close to which the meridian passes.

After some exploring on August 25, I left for Montreal lake to get my mail, hire more men and to arrange about the winter supplies. The members of my party who had helped in taking the boat down and in exploring this country, were sent back to join the main party. On September 6, the third meridian was completed.

Proceeding along the base line the nature of the country along the first ranges rendered a pack-road impossible and accordingly the horses were left near some fair feed at the south end of Lynx lake and the work was continued by means of canoe transportation and man-packing.

Several large lakes lying west of one another with quaky bogs between, were crossed by the first three ranges of the nineteenth base line and progress was very slow especially as the road even when located needed a great amount of corduroying and the building of several bridges before any freighting was practicable. Long detours had to be made to get past some bays of these lakes.

Returning from Prince Albert I rejoined the party on October 4 at section 35, township 72, range 2 and here found the head-packer to be very ill with what proved to be typhoid fever. I accordingly conveyed him to the Indian village on Egg river where there were some facilities for nursing him. To have tried to carry him to Lac la Ronge settlement at this season when snow storms were prevalent and the only accommodation for the night was a tent might have had very serious results.

The horses were now becoming fewer in number mostly from swamp fever contracted earlier in the summer, and which attacked them again while in an emaciated condition from lack of feed.

Returning from Lac la Ronge without obtaining my mail and with much difficulty as the freeze-up came very early, I rejoined my party on October 28, with a dog team and two Indians whose services had been secured by the manager of the Hudson's Bay company's trading post at Lac la Ronge.

Meanwhile the animals used by the main party were almost unable to work and several of them in their searches for feed became bogged in the partially frozen sloughs in spite of the vigilance of the packers, and died from exposure. Owing to this, the men had to carry everything on their backs and this delayed the progress of the survey considerably. I next started on the exploration of Besnard lake and Snake lake, with the timber cruiser and two men, since the two Indians wished to return to Lac la Ronge with their dogs. This exploration was necessary to find the lay of the country in the vicinity of the line and to locate and open a road for the freighters which were expected at an early date to bring some camp supplies, especially horse feed.

These men however failed us; they were very late in starting from Prince Albert where summer conditions were prevalent. They did not realize that in the northern part of the province winter had long before set in. Another reason for the delay was that they thought it absurd to use wagons and sleds on the same trip, this having never been attempted there. They spent so much time on the trip that on January 11, when they reached my camp in range 8, they had fed all my hay and part of the oats to their teams, so that not a particle of hay was left for our ponies at the most critical period of the year.

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As soon as the ice became thick enough on the lakes near the line, we started to build sleds which were hauled by members of the party and in this manner the survey work was continued.

On November 16 we set to work building larger sleighs on which the men could pull a considerable load on the ice of the lakes while the horses were regaining strength; the small sleds were found too low to be of service except on absolutely bare ice. These large sleighs were afterwards used for a considerable time along the line, until we could obtain steel-shod factory-made ones.

West of range 3, the survey was carried on much more quickly, the frozen surface on the lakes assisting the transportation of supplies, etc., and such of the horses as remained got better feeding, now that the ice was solid enough everywhere to carry their weight. Still up to the close of operations in April 1914, although they were later on well looked after, they never fully recovered from the hardships they had endured in travelling across this country, and many more of them died.

I finished the exploration of Besnard and Snake lakes on December 9, and went to camp along our sled road near section 35 township 72 range 6.

There the party joined me on the following day using the horses to draw the sleighs over the ground for the first time.

On November 14, the explorer met with an accident that prevented him from doing his work, and the exploration of the country besides my other duties, devolved on me as no other member of the party cared to undertake it, one of their principal objections being the fear of meeting timber-wolves which had attacked the explorer on one of his trips across country and which are quite numerous in this locality.

Range 7 was completed and range 8 just begun by the end of the year. With the few bags of oats the teamsters from Prince Albert had brought to camp and others that I had obtained later from the mission at lac la Plonge, the remaining six ponies were kept alive for a time but two more died on February 10. To replace these I procured two oxen from lac la Plonge and with these six animals for transport the line was surveyed to range 18.

At the beginning of April the yoke of oxen had met with accidents; both of them had been snagged and our two smallest ponies were so weak that I saw the impossibility of continuing the survey of this line to the fourth meridian, I therefore decided to close operations and return to Prince Albert.

General description of the country adjacent to the third meridian from township 68 to township 72 inclusive.

The country traversed by the twenty-four miles of this meridian is somewhat varied in character.

In township 69 there is very little dry land; the country is flat, covered with stunted small trees, and short scrub, and was half flooded at the time of the survey. These wet lands extend several miles east of the meridian, but their drainage into Montreal river is largely prevented by a sandy ridge from fifty to one hundred feet high running northerly from Montreal portage to Partridge Coop lake. Where this ridge approaches the river it is at once noticed by the precipitous cut banks of stratified sand which form the left bank in several places.

In township 70 the country consists largely of spruce and tamarack swamps intersected by ridges of sand and gravel, timbered with jack pine of a diameter seldom over six inches. West of the meridian the low lands extend almost to Smoothstone river in townships 69 and 70, range 2, leaving along this stream only a narrow strip of dry land, varying from one-quarter of a mile to two miles in width and which is fairly well wooded with birch, poplar and jackpine from four to eight inches in diameter.

A stream which starts from a large lake in townships 68 and 69, range 26, west of the second meridian meanders for twelve miles in a northwesterly direction through

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this flat country. It is a tributary of Smoothstone river and connects several lakes. One of these is quite large and is found at one mile from the confluence of the two streams, near the centre of township 70, range 2.

In the country west of Smoothstone river the same conditions exist. Judging from the numerous brooks which discharge into the river from both sides, it seems that this wet country could be easily drained as the river is almost a continuous rapid, and the fall in a short distance of its course must therefore be very great. North of the eighteenth correction line the country becomes more rolling and township 71 contains some fair land which, although of a somewhat light soil, supports a good growth of large poplar.

In township 72, range 1, the ridges consist of granitic rocks and between these lie deep bogs, many of which are partly open. There is no hay in that section of country and except in township 71, very little grass for horse feed is to be found.

In township 70, there are several lakes; two of these, in sections 25 and 34, are on Moose portage which connects Moose lake four miles east of the meridian, with Smoothstone river in township 71, range 2. This portage is travelled every summer by the natives of Snake lake; it is fourteen miles long and follows a general north-westerly course. There are on it seven lakes from half a mile to two miles long. The two longest portages are two miles and two and one-half miles; the first one begins at the west shore of Moose lake, and the other one is adjacent to Smoothstone river, which at this point flows north across section 14, township 71, range 2. On this portage the height of land rises three miles east of the river and the drainage of many of the lakes found along the portage is carried by a swift-running but deep stream, which after a long circuitous course several miles north of the portage, returns southwards towards Moose lake where it discharges at a quarter of a mile only from the beginning of the portage. I ascended this stream several miles to the first rapids, but experienced great difficulty in paddling the canvas boat through the dense willow overhanging its low banks. I found this country covered with willow swamps intersected by low ridges of sand and gravel.

Lynx creek which flows out of Lynx lake in township 72, range 1, is another very crooked stream which presented the same difficulties, increased by occasional large boulders obstructing the narrow channel. It intersects the meridian in section 12 whence it winds through township 72, range 26, west of the second meridian and there enters Morin lake at the southeast corner of the same township.

In townships 70 and 71, ranges 25 and 26, west of the second meridian are many lakes, the largest one, named Morin lake, being five miles long from east to west. It lies in township 71, partly in ranges 25 and 26. Near its eastern extremity it has two large bays extending for several miles north and south.

Moose lake and Sanderson lake are both crossed by the eighteenth correction line. The first one is connected to Morin lake by a fairly large stream five miles long. The banks are very low and grassy and the current hardly noticeable. In Sanderson lake, which is east of Moose lake, there are several wooded islands; this lake drains eastward into Morin river, and a portage one hundred yards long connects the two lakes.

Morin river carries the water from the lake of the same name into the west bay of Sikachu lake. It is eight miles long, has a slack current and in two places expands into small lakes. The banks of this river are almost on a level with the water and the marshy country which adjoins it runs back a quarter mile or more to the foot of high hills timbered with jackpine, poplar and a few spruce.

Partridge Coop lake lies in the southeastern part of township 70, range 25, and drains east into Montreal river. By a portage two miles long, one can reach Sikachu lake and avoid the longer route by Montreal river. This portage passes through fairly level lands with woods of poplar six to ten inches in diameter. From the west end of Partridge Coop lake another portage leads to the valley of Smoothstone river. It bears almost west, is eighteen miles long and crosses a very wet country covered

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with stunted trees and short scrub, except in the vicinity of the lake, where higher and fairly well timbered land exists. The Indians seldom travel over this portage before the frost has set in when it then becomes an ideal route to their hunting grounds. High dry land is found as a rule around all the above-mentioned lakes and the timber, consisting mostly of poplar and pine averages eight inches.

In the south half of townships 72, ranges 25 and 26, west of the second meridian no granite ledges were noticed. The country in general is level with occasional low ridges covered with small pine. It is drained by Lynx creek where several short rapids occur wherever it approaches the foot of the ridges. The elevation of its banks varies from three to six feet above the normal level of the water and at different places along it I saw some good hay land which could be improved by clearing it of the clumps of willow growing here and there on the grassy patches of land. By draining the wet sections of these hay meadows, they could be turned into fair pasturage.

The level country continues east into range 25 and extends south to the shores of a deep bay of Morin lake where another brook discharges. Farther north the land rises, but among the hills there appears to be a pass northwards towards the depression where Besnard lake, formerly known as Trout lake, is situated. The south shore of the latter lake is rock bound, and granite ledges, which rise up to forty feet, are found everywhere inland; between these are soft swamps and bogs. All the timber is stunted and of no commercial value.

The outlet of Besnard lake is at the northeastern corner of the lake and flows north to Churchill river. There are three rapids, two of which are avoided by portages. From the Indian village situated on the north side of the narrows of Besnard lake it takes a day and a half by canoe to go to Churchill river. The narrows are situated approximately in section 10, township 74, range 1. Here four or five families of Indians live, but although the soil in that vicinity is good, they do not raise any vegetables, being very different in that respect from their relatives living at Egg lake who, on the same kind of soil grow all the potatoes they require for their yearly consumption. The narrows are only one and one-half chains wide.

Exploration of part of Smoothstone river and the adjacent country.

Smoothstone river is with the exception of Beaver river, the largest stream intersected by my surveys. It empties into the south end of Snake lake as it is far from the ordinary routes leading north, this river and the adjoining country have very seldom been visited, except by Indian hunters. Therefore, with the intention of exploring this country I travelled a distance of forty-miles above the mouth of the river and reached the north boundary of township 69, range 2.

Such a journey if undertaken in the summer would have been very arduous owing to many long rapids which begin where the river crosses the north boundary of township 71, range 4. This work was made easy by the ice, over which I travelled quickly and with comparative safety. This allowed me to camp at points convenient for a fair examination of the country east and west of the river, to determine its possibilities as agricultural land and the value of its timber growth. The first camp was near the foot of the first rapids, fourteen miles above the estuary of the river. From this camp the exploratory line followed closely the north boundaries of townships 71, ranges 3 and 2, south of which the river flows in a general westerly direction and at distances varying from one mile and a half in the northeast part of township 71, range 2 to three miles in the northeastern part of township 71, range 3; thence its course is N. 60° W. to the foot of the rapids. This exploration shows that along this part of the river there is a strip nearly two miles and a half wide of good land wooded with poplar. This land has been burnt over and the trees of the second growth seldom reach six inches in diameter. Beyond this strip of good land are ridges with jackpine from two to ten inches in diameter. Back of the ridges tamarack and spruce swamps were crossed in which the timber is of no commercial value. At two places along the

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river banks I noticed some small clumps of spruce where a few of the trees ran up to thirty inches in diameter.

The benches along the right bank of the river often rise to fifty feet but where flats occur the banks of the river are from four to six feet high. The soil of the flats is always good as shown by the larger trees growing in such places. The width of Smoothstone river varies much. Across some of the rapids it is less than one chain and a half, while at other places it is from four to six chains wide. Its bottom is stony and the depth of the water is eight feet in many places.

The second camp was approximately in section 23, township 71, range 3, which Smoothstone river crosses from east to west. In this vicinity there are along the river some narrow flats with poplar, spruce and birch, amongst which grow thick underbrush. The benches which rise at a short distance from the river are fifty to seventy feet high and covered with second-growth poplar and jackpine. At three miles west of the river there is a lake two miles long. A dense growth of small spruce is found around this lake and it continues west another mile where a strip of good land, two miles wide lies. Ridges of jackpine and poplar divide this land from the valley of a small creek which joins the river at one mile above the first rapids. The exploration line crosses this creek at six miles from its junction with the river; at the crossing the valley is ten chains wide and covered with thick willow but beyond the creek the surface of the country is rolling. A short distance above the confluence I crossed a narrow belt of fair timber consisting of spruce from eight to fifteen inches and jackpine and balsam from six to ten inches in diameter. There is some bad windfall in this vicinity. The river benches rise to one hundred feet.

The next exploration line ran in a southwesterly direction from section 13, township 71, range 2, where Moose portage ends. Two miles and a half below it is one of the worst rapids seen on Smoothstone river. It can, however, be avoided by packing over a portage half a mile long which passes across a flat covered with scrubby birch and spruce. The country through which Moose portage passes may be described as rolling. Near one of the lakes in the middle of the portage there is a patch of spruce from ten to eighteen inches in diameter, but the timber consists mostly of jackpine from six to twelve inches; poplar running up to ten inches cover large areas. North of the portage a forest fire was still burning through the second growth of trees found there. The more level and best wooded lands are generally near the lakes, around which the soil is fair, but I did not see any hay meadows as the valleys of all the streams connecting these lakes were everywhere covered with dense willow and alder. At half a mile above the point where Moose portage reaches Smoothstone river, the high benches, which from the first rapids were a prominent feature along its banks, gradually recede from the river, leaving long stretches that are covered with willow and swamps. There are many small islands in that part of the river.

The timber cruiser who explored townships 71 and part of 70, range 2, reports crossing, after leaving the river, a strip of land two miles wide and timbered with poplar and spruce; the country farther west he describes as rolling and covered with jackpine and small spruce. The same day I travelled nine miles by the river as far as the confluence of a large brook which flows from a southeasterly direction. Here I noticed a dog trail and as the ice on the river was unsafe, I decided to follow this trail over which I could make good progress. From Smoothstone river it runs S. 20° W. for four miles and crosses a flat country sometimes covered with short scrub. At many places it is open and grassy. It extends east beyond the third meridian; a few knolls only rise from this flat swampy expanse, one lies west of the trail and another one is close to the north shore of a lake, two miles long and one mile wide. The valley of the river is not more than two miles west of the trail and is defined by low ridges wooded with pine and poplar. After crossing the lake the general direction of the dog trail is south and west and the distance to Smoothstone river is four miles, most of it through spruce swamp and a few open bogs with narrow ridges across. When within

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One-third of a mile from where it again strikes the river it enters a belt of jackpine and poplar from four to six inches in diameter. I was quite surprised to find that at this point Smoothstone river was entirely free from ice. It is about three chains wide; its right bank is fifty feet high, but the other bank is low, grassy and covered with willow and the country back of it appears to be swampy. A branch of the trail which I had followed in going to Smoothstone river leaves the main trail at two miles and a half north of the small lake mentioned above. It runs almost east and intersects the third meridian at the corner of section 1, township 69. This dog-trail evidently ends at Partridge Coop lake. We then went to section 30, township 70, range 1 where we found a newly-built Indian hut, and as there was no one living in it we took possession for the night. This shack is on the right-hand side of the river, and stands in a flat where spruce and jackpine from four to eight inches grow. Smoothstone river here is six chains wide and for three miles north is free from rapids. There are grassy marshes along the left bank.

The country west of the river in township 70, is fairly high for a quarter of a mile or so, but this narrow strip of dry land comes to an end a few miles farther on where the swamp back of it comes to the river. The water in the numerous brooks which rise in these swamps tastes strongly of iron.

On Smoothstone river large water-powers could be developed.

General remarks.

During my surveys I saw very little land at present suitable for settlement along the third meridian and for a considerable distance west of it. The sections of country at present fit for agriculture are very sparsely distributed in this region. The arable land consists of clay loam and is generally found in proximity to some of the largest lakes and in the valleys of the principal streams. Hay lands are also very scarce through all this district. Whenever seen they were always submerged and in most cases would be hard to reclaim, being so little above the level of the lakes and streams. Moreover these grassy stretches are more in the form of bogs than regular hay meadows. The country improves to a certain extent west of Beaver river both in the quality of the soil and also the growth of timber, which is much better in size and quantity.

At places where the land has been tilled, the crops have proved satisfactory and have never been seriously damaged by summer frosts. The principal revenue of the country is still derived from the fur trade to which has been added in recent years the produce from the yearly increasing fishing industries. The I. C. Fish Co., which is the pioneer in this province, intends to establish new fisheries and in connection with this industry have this spring erected a saw-mill at Ile-a-la-Crosse settlement. They will now be able to manufacture their own boxes of which several thousands are required, and which up to the present date have had to be brought in by teams.

All the lakes in the district are well stocked with the best species of fish including trout and whitefish. There are also quantities of pike, pickerel, carp, etc.

Water-power could be developed on Montreal river as the drop in the whole course of this stream is 350 feet, whilst at Montreal rapids which are about eight miles long the fall is 105 feet. Farther down stream at Mountain rapids the drop in two miles and a half is 40 feet.

Large game such as moose, caribou and deer, is plentiful. In one herd which I saw east of lac la Plonge I counted twenty-three head. As might naturally be surmised the predatory animals, such as timber-wolves infest this country. Of the fur-bearing animals, bears, lynx, marten, mink, coyotes, foxes and otter are often seen. The ubiquitous muskrat is still there in great numbers. Of beaver, traces only of their work were noticed on Tippeo river.

No minerals were found but quarries of building stones could be opened in the granite ledges seen south of Besnard lake.

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APPENDIX No. 49.

ABSTRACT OF THE REPORT OF J. B. SAINT CYR, D.L.S.

STADIA SURVEYS IN THE VICINITY OF RED DEER, ALBERTA.

My party was organized at Edmonton, and on May 14, 1913, I left for Gull lake the scene of my first work which consisted of the survey of this lake and of those in the surrounding townships.

At the south end of Gull lake which is situated in township 40, range 28 west of the fourth meridian a great number of cottages have lately been built. It is a fine summer resort, and hundreds of people from Edmonton, Red Deer, Lacombe, Ponoka and other places spend a part of the summer there. The lake is deep, contains clear soft water, and is well stocked with pike and pickerel. Wiseville which is south of the lake is the principal village in that township. The greater part of the village is situated on section 22. All that country situated between the Blindman valley to the west of Gull lake and Lacombe and Ponoka to the east is good farming country. The surface is half prairie and half bush and is hilly and rolling. Oats are grown in that district in larger quantities than wheat. In the gardens all kinds of vegetables are grown successfully. The farmers also raise hogs and horses on a large scale.

After leaving the vicinity of Gull lake we travelled from township to township throughout the district lying east and southeast of Red Deer, traversing all the lakes which were large enough and deep enough to warrant it. During the season fifty-four townships were visited and investigated and hundreds of lakes were traversed.

In all the townships in which we worked the country is more or less open. Wheat is grown in larger quantities through the eastern part of this district than in the western part. In nearly every locality where I travelled during the summer of 1913, mixed farming was carried on by all the farmers. Every settler praises the country highly for its great agricultural possibilities. The fall was remarkably dry and mild, the sun shining almost every day for several weeks. The coldest period experienced in December was ten degrees below zero, for four or five days.

On January 6, 1914, I returned to Edmonton after eight months in the field having moved camp about fifty times and travelled over a thousand miles.

APPENDIX No. 50.

ABSTRACT OF THE REPORT OF B. H. SEGRE, D.L.S.

STADIA SURVEYS IN THE REGINA DISTRICT.

My work for the season of 1913 consisted of the investigation and traverse of lakes in townships north and west of Regina.

My first work was in township 17, range 22, west of the second meridian. This township is all gently undulating prairie and the lakes and marshes have either entirely dried up, or dry up in the fall of each year. The large lake formerly in section 17 of this township has completely dried up and now provides excellent grazing land for stock. To the west the country becomes more rolling towards Moosejaw creek, the valley of which is nearly 250 feet below the level of the surrounding area; west of this creek the prairie becomes less broken and no marshes were noticed.

Northerly towards township 20, range 22, the country becomes more and more rolling and there are many marshes and sloughs which contain only the surplus water of the spring and which dry up in autumn. Many alkaline lakes were found in this township, lying in valleys about fifty feet deep; these lakes are shallow and contain strongly saline water, but they are fed by springs and will be permanent.

From this township I proceeded to township 18, range 24. I found that the majority of the lakes in the township had changed very little since the original survey. Rocky lake was about six feet deep in places and its water was slightly alkaline, the surrounding country is rolling prairie becoming more and more broken to the west in range 25.

My next work was the survey of Buffalo Pound lake in townships 18, 19 and 20, ranges 25 and 26. This lake lies in a valley, the banks of which rise 300 feet above water level. The shores are marshy for the most part, and long reeds fringe them for a distance of from five to ten chains from the high-water mark; this feature is no doubt due to the shallowness of the lake, the greatest depth being eight feet. The maximum depth is reached about ten chains from shore on both sides, thus revealing a very uniform bed in the centre of the lake. A small creek enters the lake at the north end, and this together with numerous springs constitute its source of supply. It is drained through Qu'Appelle river at the south end. The slopes of the valley are covered with a dense growth of poplar and willow scrub. An abundance of grass furnishes ample pasture for stock.

This lake seems to be the dividing line between two different types of country.

The land above the valley on the west side is gently undulating prairie with good sandy loam, free from stones, while that part lying on the east side of the lake is very hilly and rolling and the soil is freely intermixed with granite boulders, requiring more expense in carrying on farming operations.

This seeming disadvantage however, is more than offset by the fact that farmers living above the valley on the west side, find great difficulty in securing water. It can be obtained only at great depths and even then it is of very inferior quality. Those on the east side on the other hand get an abundance of good water near the surface.

The water of this lake is very alkaline which no doubt accounts for the fact that there are no fish in it, although many fish are caught in Moosejaw creek which joins Qu'Appelle river just east of the lake.

Having completed the traverse of Buffalo Pound lake, my next work consisted of the investigation of small lakes and marshes in township 21, range 26. The country



Bear in Jasper Park, Alberta.

Photo by H. Matheson, D.L.S.

This small black bear up a large Douglas-fir tree, near lake Annette in Jasper Park, is waiting for his lunch. Labourers constructing roads near by used to eat their mid-day lunches near this tree and feed scraps to the bear, so that he became quite tame.

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around these lakes is very hilly prairie, and no doubt the lakes are formed from the surplus run-off of the surrounding area. No large creeks or springs were found which could be called a source of supply, yet the lakes seemed permanent and no change in the high water mark could be noticed.

From there we moved camp to township 22, range 27, and surveyed a lake near Aylesbury. The water of this lake is slightly alkaline and lies in a valley, the banks of which rise from 50 to 100 feet above water level. There are numerous small springs along the sides which constitute the source of supply, and a small creek at the south end apparently drains the lake. The greatest depth is about ten feet. There are no fish in this lake.

From this township I crossed the valley of Arm river and after making an investigation in township 26, range 27, I moved camp to township 26, range 25. Here my work consisted in traversing a large lake near the town of Stalwart. This lake is nothing more than a large marsh filled with alkaline water, three feet being its greatest depth; the greater portion of the lake is covered by reeds. A small creek enters from the northwest forming the only visible source of supply and another small creek drains it to the southwest; this creek eventually enters an arm of Last Mountain lake. On account of the amount of weeds growing in this lake, it is the resort of a great number of ducks and other water-fowl, which nest along its banks. A number of marshes were also investigated and traversed in this township; they were all shallow and distinctly alkaline in taste. A few alkaline flats lie in the western part of this township, rendering many hundreds of acres useless for grain growing purposes. The country between this township and Last Mountain lake is gently rolling prairie; but west of this, the ground becomes more and more broken and covered by boulders. Very little road-building has been done in this township on account of the number of sloughs to be crossed. This hampers the farmer very much in the speedy transport of his grain to the railway.

We next moved camp to township 27, range 24, and investigated many small marshes in this township and also in township 28. There the country is not as hilly as is usual in this district and the majority of the marshes, having dried up, produce excellent hay. In many instances the former beds of marshes have been ploughed up and are producing grain.

Bullrush lake in township 28, range 25, was traversed from this camp. This lake resembles a large marsh, the greatest depth of water being three feet, and a thick growth of grass covering the entire bed. The water has receded in many cases and parts of the former bed are now being utilized for hay growing. There are unmistakable signs that this lake has dried up before, as old haystacks were seen in the centre of the area now covered by water, and the marks of the plough were noticed, the old furrows being now under water; the bed of the lake, however, being the natural receptacle for the run-off of a large area, is liable to flooding in wet years.

From this camp I commenced the survey of Last Mountain lake, the largest body of really fresh water in central Saskatchewan. The north end of this lake consists of three long arms, into which flow as many creeks, while along the shore numerous springs and creeks enter. These drain a very large area, and maintain the lake at an almost constant level. Soundings were taken in the north end amongst the many islands, and the greatest depth recorded was ten feet. Farther south, however, the depth increased, and from information obtained from the captain of the steamer which plies up and down the lake, I was led to believe that the greatest depth is near the southern end and is about one hundred and thirty feet.

There are numerous summer resorts along this lake, the most important being Regina beach and Saskatchewan beach, the former on the west shore, and the latter on the east shore, both served by the Canadian Pacific railway from Regina and Saskatoon. The lake provides excellent fishing during the summer; pike, pickerel and whitefish being caught in abundance. A few fishermen make a living by summer fishing,

but in winter operations are carried on more extensively, about one hundred men being engaged in this occupation. The fish finds a ready market in Regina.

At the north end the shores of the lake are more or less marshy with low banks, but as we worked south along the west shore, the banks commenced to rise abruptly from the water's edge, in township 22. These banks became gradually steeper until township 21 was reached where the valley is about 250 feet deep and stretches back for a distance of from twenty to forty chains from the water's edge. Commencing in township 22 vegetation is to be found along the shores, which are for the most part sandy. Groves of ash and willow which extend to the water's edge, delayed traversing considerably in the summer; it was therefore found advisable to cease operations for the time being, when the north boundary of township 21, range 22, was reached. A return was made to the lake when the ice formed and the traverse of the west shore was completed, as well as the east shore south of township 25, range 24.

The largest body of water entering the lake is Arm river which forms a long estuary running nearly two miles from the main body of the lake. This lake is drained by a river which flows through a large marsh at the southeast end, finally joining Qu'Appelle river. During the traverse of this lake numerous investigations were carried on in the townships passed through, the majority being of shallow marshes and lakes, the water of which was alkaline, and the shores of which were covered with reeds and marsh grass. A few of these marshes have dried up and are producing hay, but the most of them contained water all through the past season. The country on the west side of Last Mountain lake is gently rolling prairie at the north end, and becomes more hilly and broken toward the south, township 21 being very rough and containing many small lakes. The water in these lakes was for the most part slightly alkaline, but wherever it was found to be not too salty, it was of great use to the farmers, providing drinking water for the stock in many districts where the obtaining of a large quantity of water is a serious problem.

After leaving the traverse of the west shore of Last Mountain lake, investigations were carried on in townships 20 and 21, range 21. A few small lakes were found which were shallow but evidently permanent. The marshes in these townships have dried up considerably, but being low spots in scrubby country are likely to hold the snow and contain water in early spring. The valley of Qu'Appelle river divides the topography of the country, the south side of the valley being gently undulating prairie, and the north side being rolling country covered by poplar and willow bluffs. In the river valley there is excellent pasture land, and it is an ideal spot for stock-raising.

Camp was next moved to township 23, range 19 where further investigations were carried on. This district is mostly rolling prairie with many shallow sloughs, quite a number of which have dried up and are now producing hay.

From there camp was moved to township 25, range 19 and once more rough rolling country was encountered.

A branch of Loon creek flows through the eastern part of this township and provides drainage for a large area. The valley of this creek is from fifty to seventy-five feet deep, and is covered with thick bluffs of poplar and willow in the southeastern end of the township. There are also several marshes in the creek valley. Three lakes traversed in sections 22 and 27 were found to be permanent, they lie in a valley from twenty to thirty feet deep and apparently receive the drainage of a large area in the northeastern part of the township. Most of the small marshes investigated are now dry and are used for growing hay. A large lake in township 26, range 19, was traversed and found to be permanent but the marshes in this township have all dried up and produce hay.

Our next camp was in township 25, range 22. All the lakes examined in this township were strongly alkaline, and are drying up: in section 29, the greater part of the former bed of the lake is now dry and producing hay. The country is very rolling

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in this township becoming more and more broken until Last mountain is reached in range 21, where the hills rise abruptly from 300 to 500 feet and are cut by deep valleys, which at present greatly impede traffic from the East. One large marsh at the north-east corner of this township lies at the base of Last mountain. This marsh does not exceed one and a half feet in depth, and is almost completely covered by a thick growth of reeds and marsh grass; however, it receives the drainage of a very large area, and will be permanent, although its shores may be subject to wide variations according to the season. To the south of this township many alkaline lakes were traversed, they were all shallow, but they will likely all be permanent. The country is rough rolling prairie, and there are no creeks to drain these lakes. A number of marshes were investigated in this township and also to the west; the majority appear to be drying up and are being used to produce hay.

From there, camp was again moved to Last Mountain lake in township 25, range 24, and the traverse of the east shore commenced by running south from the north boundary of the township. The shore line in the northern part of township 25 is marshy, but farther south it is for the most part sandy with banks rising from three to ten feet high from the water's edge. In township 23 the banks become steeper and more abrupt, until township 21 is reached where the valley is 250 feet deep and similar to the valley on the western shore; being covered by poplar and willow scrub and a good growth of grass affording good pasture for stock. This lake becomes gradually more shallow as the south end is reached, and at the point where the Canadian Pacific railway grade crosses it the maximum depth is three and a half feet. South of this grade there is a great change in the lake as the open water gives place to a large marsh covered by reeds and marsh grass with water one to three feet deep. The creek which drains the lake meanders through this marsh finally joining Qu'Appelle river at Craven. The land covered by the waters of the marsh is more or less useless except for water-fowl, but a strip of low land about five chains wide and one foot above water level extend along both banks of the creek and may provide pasture. On completion of this work, I made a traverse of that part of the lake in section 30, township 28, range 23. I then returned to Regina and disbanded my party.

APPENDIX No. 51.

ABSTRACT OF THE REPORT OF F. V. SEIBERT, D.L.S.

SURVEY OF THE TWENTY-FIRST BASE LINE FROM THE FOURTH TO THE FIFTH MERIDIAN.

To survey the twenty-first base line it was necessary to have supplies placed near the latitude of the line and west of the fourth meridian, yet close enough to the latter to be within easy reach of the starting point of the line. With this in view my assistant left Edmonton on February 12, 1913 to build a cache on Christina river near where the line would cross and to clear the old trails and cut new ones where necessary. His route led by way of Athabaska and Lac LaBiche settlements, thence over the wagon road to Heart lake, and from there northerly to Wappau lake over the sleigh trail used by Mr. G. McMillan, D.L.S. in placing supplies for the twentieth base. From Wappau lake he expected to go down May river to Christina river and then along this river to the latitude of the line. When he reached May river, however he found that the deep snow had kept the river from freezing over in many places, necessitating more cutting than he had expected. He therefore decided to build a cache at the northerly end of Wappau lake, return to Lac LaBiche to report and have the freight sent on to the cache, and then report to me at Edmonton. He arrived at Edmonton March 11.

The following day my party left for the work, going by the Canadian Northern railway to Athabaska and thence by teams and sleighs to Lac LaBiche. When we arrived there on March 20 we found that the deep snow with the heavy crust had retarded the forwarding of freight; the larger part of the supplies were still at Lac LaBiche and the remainder had been taken about twenty miles north of Heart lake where they had been left by the freighters when their teams became exhausted.

We left Lac LaBiche on March 21 with eight teams and ten of our best pack horses, leaving the remainder there. We took nearly all the camp supplies with us and before leaving we made arrangements for more teams to follow with the remainder and sufficient hay and oats to take us to our destination.

At noon March 24 we reached the cache made by the freighters on their first trip. Up to this point it was easy travelling as the trail was broken but from there on travelling was very slow and extremely hard on the horses, as their legs soon became seriously cut by the crust, and they showed signs of playing out. We procured four sets of double harness and one set of sleighs left by Mr. Blanchet, D.L.S. on the nineteenth base line and made use of the flat sleigh we had with us. I also decided to relieve the horses to some extent by having my men break down the crust ahead of the teams. On March 28, we reached the cache built by Mr. Logan and after resting there one day, we proceeded down May river, cutting out portages where necessary. We reached Christina river on March 30.

Our supply of hay and oats was low, so I decided to return with one of my teams and all the hired teams to meet the teams coming in with more. We returned to Christina river on April 4, and my hired teams stayed with me one day more taking us about twelve miles down the river. From there I allowed them to return to Lac LaBiche. We then moved camp and supplies about twelve miles farther down the river to the crossing of the McMurray summer pack trail, getting everything there by April 15. We used the sleighs on the river for the last time on the 11th and then packed what was left over land.

In April 19 the packponies we had left at Lac LaBiche arrived and we at once started to pack to the latitude of our line cutting our trail as we went and following

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the east bank of the Christina. We took only the necessary supplies and outfit, and made a cache of the remainder. When we were about four miles south of the latitude of the twenty-first base line we struck an old trail running easterly which was part of the trail running from Winefred lake to McMurray. We opened up this trail as far as Cowpar lake and from there cut trail easterly to the fourth meridian pack trail on Landels river. We reached the starting point of our line on May 3 and commenced our survey on the 5th.

The supplies we took with us to the meridian lasted until we ran the line as far as the summer pack trail between Lac LaBiche and McMurray, which we reached on June 1. We were then in touch with the cache we had made in April on Christina river, which was two days' travel by pack train south of the line. During our absence this cache had been broken into and about nine hundred pounds of supplies taken, as well as a quantity of clothing belonging to myself and men. Fortunately we had still enough supplies but my men were short of the necessary clothing.

Large areas of muskeg exist in the country traversed by the twenty-first base line between the fourth meridian and Athabaska river, but nearly all of this can be easily drained. The river valleys have in most cases good land. Beginning at the fourth meridian and going west good land is to be found along Landels and Winefred rivers as well as around Cowpar lake. At the latter place a few Indian families make their permanent home. Where the line crosses it Christina river has a low valley which extends either way for about twelve miles. In some places this valley is low and wet but it could be easily drained. The land close to the river is excellent, becoming lighter, however, the farther it is from the river. The strip of land between the Little Rocky mountains and the Christina is mostly of excellent quality.

The Little Rocky mountains in ranges 6 and 7 make a distinct break in the country. They rise rather abruptly from the rolling country bordering on the Christina to a plateau composed chiefly of muskeg and sandy rocky ridges. They are more pronounced to the north running off into low hills to the south. The same formation appears in ranges 12 and 13 with the drop towards the west instead of the east as in ranges 6 and 7. They are also more pronounced to the north and barely noticeable to the south. Ranges 13, 14 and 15 contain large areas of muskeg with ridges, running northerly which to a large extent prevent the drainage from taking its natural course westward. These ridges are very little higher than the muskegs which border them on the east, but they have a decided slope to the west and give the country the appearance of being composed of a series of plateaus with a general fall to the west.

House river in range 16 has a valley which is from three hundred to three hundred and fifty feet deep. The river can be navigated with canoes a greater part of its length. Patches of large spruce are still preserved in the valley but a much larger area has been destroyed by fire.

The strip of land between House and Athabaska rivers is mostly muskeg which could be very easily drained to the deep valleys on either side.

The Athabaska which is crossed by the line in range 17 has a valley from two to three miles wide and averaging about four hundred feet deep. Here also a great deal of large spruce has been destroyed by fire, but much still remains. A fire ranger with headquarters at Pelican portage patrols the river, working in conjunction with the fire patrol boat which has its headquarters at Athabaska, and much of the waste by fire will no doubt be prevented.

Drilling has been done at Pelican portage and gas has been found in each of the four wells drilled.

On the west side of the Athabaska muskeg extends for many miles westward. This muskeg extends north as far as the correction line and south to Pelican river which flows into the Athabaska from the west. On account of the very wet summer this muskeg was impassable; and it was therefore necessary to leave this part of the line till winter.

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Accordingly we left the line on September 29 and tracked up the river with a scow and canoe, arriving at Athabaska on October 7 and at Edmonton on the 9th.

We left Edmonton again by the Canadian Northern railway for Athabaska on January 2, 1914 and reached there the same day. There we met four of my teams which I had sent overland by trail from Edmonton. We left Athabaska on the 5th, and following down Athabaska river, reached Pelican portage on the 10th. We rested the horses there a day, and then continued down the river reaching the crossing of the line in two days. In making the trip to this place we broke trail most of the way from Athabaska, but experienced no serious difficulty until we were within about ten miles of Pelican portage. From there we encountered rough ice most of the way to the line. At Pelican rapids the ice was in some places piled ten feet high, and it required considerable cutting to get a trail through it. With the party ahead of the teams cutting down the ice the delay was slight. Two days cutting trail from the river took us up over the edge of the valley to the centre of range 18 where we had left the line in September.

We started the line on January 16, and made good progress with its production, reaching the fifth meridian on February 23.

We cached our main stock of supplies at the river and forwarded them along the line on bob-sleighs at the river using four teams from my pack outfit for the purpose.

The country from the banks of Athabaska river about the east boundary of range 18 to the east boundary of section 32, range 23, a distance of thirty-four miles, is mostly muskeg. To the south this muskeg extends to Pelican river which follows roughly the twentieth correction line, and to the north it extends beyond the twenty-first correction line. Muskeg creek in range 20 is too small to be used by canoes, and the only way to cross this country is over the frozen muskeg. The tamarack in some parts of the muskeg and the jackpine on some small islands of sandy land is large enough for railway ties, but ninety per cent of this area is covered with timber too small for use.

West of the east boundary of section 32, range 23, the character of the country changes entirely, the surface becoming rolling. Very little muskeg exists, and some good spruce and poplar is still preserved. There is not enough timber in any one place for a timber berth, but there is sufficient for the needs of settlers. The land is good.

The line crosses north Wabiskaw lake in ranges 25 and 26. South Wabiskaw lake is about four miles south of the line in ranges 24 and 25, and Sandy lake is situated in township 79, range 23. All of these lakes contain whitefish.

The settlement of Wabiskaw lies at the southeast corner of north Wabiskaw lake. To reach it there is a choice of two trails in winter and three in summer. One of the winter trails crosses from south Wabiskaw lake over Pelican mountains to Rock Island lake, then to Calling lake, and from there to a point on Athabaska river, twelve miles from Athabaska. Another branch of the same trail leads from Calling lake to a point on Athabaska river, called the "fish camp," about seventy miles up the river from Athabaska. This branch of the trail is not used much now. There are some bad hills going over the Pelican mountains, and another leaving Athabaska river. The trip from Athabaska to Wabiskaw by this trail can be made, with moderate loads and good weather, in five days. The other winter trail is by way of Sandy lake, Pelican lake, Pelican river, and Athabaska river to Athabaska. This is a very much longer route, but has the advantage of having only one hill, which is at Athabaska river. The regular winter freight rate from Athabaska to Wabiskaw is two and a half cents per pound. In summer there is a canoe route by way of Sandy lake, Pelican lake and river, and Athabaska river. Two pack trails can be used in summer to reach this post, one by way of Calling lake, and Rock Island lake, and the other by way of Sawridge on Lesser Slave river. The latter I am told is much the better trail and is cut out for wagons part of the way.

No indications of minerals were noticed during the season.

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APPENDIX No. 52.

REPORT OF N. C. STEWART, D.L.S.

SURVEYS IN THE RAILWAY BELT OF BRITISH COLUMBIA.

VANCOUVER, B. C., January 28, 1911.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report of my season's operations in the railway belt in the province of British Columbia.

After organizing my party at Revelstoke I left for township 20, range 9, west of the sixth meridian where my first work was located. I arrived there on May 8 and pitched my first camp beside the new automobile road which was being constructed between Salmon Arm and Enderby. I surveyed the east boundaries of sections 4 and 9 and moved camp by wagon along the road to Enderby about six miles, then taking a branch road which leads around Sugarloaf mountain I was able to get my outfit to the southeast quarter of section 35, township 19, range 9. The road around the mountain was very rough and steep and I required two teams to haul my outfit over it. Several fine farms surround the mountain and others were being taken up on the bench land which extends northward from this mountain for nearly three miles. I surveyed the east boundaries of sections 2 and 11 and the north boundaries of sections 1 and 12, in township 20, range 9, thus opening all that bench land for settlement. The soil is generally a light sandy loam and very stony. A muskeg about eighty acres in extent, known locally as "Mara Meadows," was found in section 12: this will need considerable drainage before it will produce hay. Marketable timber was found in parts of sections 1, 12 and 13.

On May 28 we moved to Grindrod, the nearest railway station, and took train to Chase. The following day we crossed Little Shuswap lake on the Adams River Lumber company's launch and teams were hired to take the outfit to Adams lake which was reached rather late that night. The road between the two lakes is very steep in places ascending a mountain and then descending again although I believe the difference of level between the lakes is only 150 feet. On May 30 with the aid of a small steamer and a scow we arrived at section 28, township 25, range 12. All the land in this township north of Adams lake including four miles of the north limit of the railway belt was surveyed. I triangulated across the lake on the east boundaries of sections 28 and 21, traversed a few miles of the southeast shore of the lake and ran sufficient lines to survey all the land likely to be required for agricultural purposes in the township. While there we experienced very wet weather and several severe storms.

The next work was in township 24, range 13, west of the sixth meridian. Here I again triangulated Adams lake from a post found on the north boundary of section 27 to a point on the north boundary of section 26. The land in sections 35 and 26 and the northeast quarter of section 23 was surveyed. This part of the lake which is opposite to Agate bay (known locally as "Squam bay") is said to be the only part of the lake free from ice in the winter.

My next move was across Adams lake to Pass creek and then by wagon road to section 1, township 25, range 14, west of the sixth meridian. There I ran the north boundary of the section which is also the north limit of the railway belt. This

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line ran along the side of an almost perpendicular mountain which rises about 2,500 feet above the valley. I also attempted to retrace the boundaries of the Homestake group of mineral claims which are located in this section, but most of the monuments of the original survey had disappeared.

Adams lake is more interesting from a scenic and geological than from a settler's standpoint, as there is very little agricultural land near it, its shores being generally perpendicular cliffs. The lake is subject to sudden and violent wind storms making it dangerous for small boats and canoes.

The surveys in the vicinity of Adams lake were completed on July 17, and on July 19 camp was pitched beside Columbia river near the south boundary of section 14, township 23, range 18, west of the fifth meridian, a move of nearly 250 miles, requiring eight changes of conveyances.

My work in this locality consisted of running the south limit of the railway belt from the Columbia valley over the Beaverfoot range, and across the Kootenay valley. The Beaverfoot mountains are very picturesque from a tourist point of view but they are not so inviting to a surveyor. I opened up an old hunting trail that ran along the mountains to the north of Cedar creek and extended this trail to the headwaters of that creek, but could go no farther on account of rock bluffs around which a trail could not be built. I had two camps on the western slope. From the second camp to the summit there was a very steep ascent of about 2,000 feet. I sent the pack train with provisions around into Kootenay valley by way of Vermilion pass, the trip taking five days on account of the distance and the number of trees fallen across the trail. Meanwhile we packed the remainder of the outfit over the summit and about 2,000 feet down the other side to the first creek. We also cut a trail out to the main one along Kootenay river, thus making connections with the pack train. During the work on the summit we had very wet weather with some snow, hail and fog.

Kootenay valley is nearly four miles wide where the south limit of the railway belt crosses it. The soil is gravelly in most places, but near the river clay was found. The western side of the valley is heavily timbered with spruce, but the lower benches are chiefly covered with a jackpine *brulé*. The eastern side is covered with fir, spruce and jackpine.

Wild goats are very plentiful on the Beaverfoot mountains, while deer and moose were often seen along Kootenay river. Trout fishing was good in the river and in the lakes along its valley.

On August 30 we started for Leancoil along a good trail which connects with a wagon road eleven miles from the Canadian Pacific railway. The scenery along this trail was magnificent.

From Leancoil we moved to township 23, range 2, west of the sixth meridian, where camp was pitched about five miles southeast of Revelstoke on September 1. The surveys here included the outlines of some timber berths and were very difficult to make owing to the long climb to work, the large size of the timber and the very wet weather. The remainder of the surveys in this township were traverses of four small islands in Columbia river and a lake on the north boundary of section 14.

From September 26 to November 20 surveys were made along the main line of the Canadian Pacific railway from Boulder to Craigellachie, the work consisting of surveying all land likely to be required for settlement and making ties to the new double track survey of the railway.

From Craigellachie I went to Enderby and thence by wagon to township 18, range 8, west of the sixth meridian, where I completed the survey of timber berth No. 558. Eight inches of snow fell while we were in this township.

On November 27 we left for Enderby and the following day moved by wagon to Salmon river and camped in section 7, township 18, range 10. There was no snow on the ground in this township which was a welcome change from the country farther east. The work consisted of running the west boundaries of sections 6 and 7. All the country from Enderby to Salmon river and down the river to Shuswap lake is thickly settled, and all the farmers seem to be prosperous.

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Section 17, township 21, range 10, west of the sixth meridian was next reached. The west and east boundaries of the section were surveyed and on December 10 we moved by wagons about ten miles into Skimikin valley and camped in the southeast quarter of section 18, township 21, range 11. The road from Tappen through this valley is in good condition; it is an old road and is therefore well known. A large bench containing some good land in section 7 on the south side of the valley was surveyed. The farmers in Skimikin valley are fairly prosperous, one of them having about 150 head of stock.

Owing to the snow and the short days I decided to disband the party, and on December 23 I left for Revelstoke arriving there the following day with my outfit.

I have the honour to be, Sir,

Your obedient servant,

N. C. STEWART, D.L.S.

APPENDIX No. 53.

REPORT OF P. B. STREET, D.L.S.

SUBDIVISION IN NORTHERN MANITOBA.

WINNIPEG, MAN., May 20, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following general report of my survey in northern Manitoba during the season of 1913-14.

I reached Pas on June 20, 1913, and tried for several days to hire sufficient labourers for my party. Owing to the demand for labour on the Hudson Bay railway, I was able to secure only one man at this place. I had brought in several men from the outside points and commenced work with them in township 53, range 27, west of the principal meridian, on June 27. As soon as the work was well under way, I went to Prince Albert to secure the remainder of my party.

Our first work was the partial subdivision of townships 53 and 54, ranges 26 and 27. Pasquia river flows through these townships, emptying into Pasquia lake, a large shallow body of water, about twelve miles long and five miles wide with a maximum depth of about six feet at high water. The river leaves the lake again in township 56, range 26, and empties into Saskatchewan river. The Saskatchewan rises so high during June and July that the water is forced back up the Pasquia into Pasquia lake, which in turn overflows the surrounding country, rendering it useless for agriculture. When the Saskatchewan is lowered, and this overflow is prevented, some very good farmlands can be easily reclaimed. We saw hundreds of acres of fine hay growing five and six feet high in this vicinity. Summer frosts seem to be unknown, September 8 being the first day on which frost was recorded. No timber of any value was seen in these townships. East of the Pasquia the ground is covered with deep moss, which holds back the water like a sponge and prevents drainage, but there is plenty of slope to insure natural drainage if this moss were removed. This vicinity will be most valuable as a mixed farming district when the land is thus reclaimed. During our operations in this vicinity, we moved our camps either by boat on the Pasquia, or by means of a push car on the Canadian Northern railway which follows the same direction as the river.

On October 6, we moved north of Pas to make a partial subdivision of the townships along the Hudson Bay railway. This country is mostly swamp and muskeg, the ground being covered with a rank growth of moss, which frequently reaches a depth of six feet. Naturally drainage is impossible until the moss is removed. Ice can be found in July by removing a couple of feet of this moss, so that it is only natural to find that the spruce and tamarack which grow in these muskegs are very stunted. Occasionally patches of large spruce and tamarack are found. Gravel and rock ridges are common and are covered with spruce and jackpine. Two large lakes, Clearwater and Cormorant, lie northeast of Pas, and are nearly surrounded with rocky limestone ridges. The lands bordering on these lakes are mostly of a gravelly clay formation, covered with a very dense growth of spruce, jackpine, poplar and birch, ranging from three to ten inches in diameter. Very little of this wood is of any value for lumber but it makes a very attractive cordwood proposition. Unfortunately

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in clearing the right of way for the Hudson Bay railway, fires were allowed to spread, which destroyed several square miles of good jackpine timber. A large area lying between the Hudson Bay railway and Moose lake appears to be a totally useless swamp. It is regularly overflowed by the Saskatchewan at high water, and in many places it is impossible to find the bottom with a long pole. It is very doubtful if this area can be reclaimed.

We subdivided lands adjoining the Hudson Bay railway from mile 15 to mile 56. The muskegs froze about October 20, and during the next two months, we made very good progress with our work, as the weather was not very cold and there was little snow to impede our movements. After December we had frequent snowfalls until the snow attained a depth of thirty inches by April. During February, we had the usual cold spell, the thermometer for three weeks hovering between 30 and 50 degrees below zero. The lowest temperature recorded was 53 degrees below zero. During this cold period our axes suffered considerably. The blades chipped off every time a dry tree was encountered and the handles snapped in two nearly as fast as they could be replaced. Mounding on the gravel ridges was so tedious that many of the mounds were left until May. Fifty-four inches of ice formed on Clearwater lake prior to March 1.

Fishing in Clearwater, Cormorant and Moose lakes is carried on extensively every winter. Whitefish, trout, pickerel and jackfish are taken in large quantities and shipped from Pas. We saw several moose in this vicinity and a few caribou. Ptarmigan are very plentiful while the snow is on the ground, and, as might be expected, the numerous lakes around Pas are well stocked with geese and ducks of all varieties, affording excellent sport both in the spring and autumn.

The Hudson Bay railway is being built as rapidly as circumstances will allow. Crossing a muskeg country, as it does, it is very hard to get a good roadbed and the construction company have been very unfortunate in not finding suitable gravel pits for ballast. Gravel has had to be hauled for very long distances and the nature of the country requires an unusual amount of ballast to make a good road bed. The line has been well laid out with long tangents and easy curves, and when the road is finished, will be able to take care of heavy traffic.

High winds are very prevalent in this district, both in summer and in winter. We found it useless to break snow-shoe trails through the deep snow, as they are almost invariably drifted full and obliterated in a few hours. Except on the big lakes, the snow never seems to get sufficient crust to make good snow-shoeing.

By May 1, the country was becoming so wet that I decided to discontinue work as soon as I completed the necessary surveys in township 58, range 23, where I was then working. I kept a sub-party busy most of the time erecting monuments which had been left during the winter, and on May 14, we had completed our work and moved back to Pas, where I paid off the party. After storing my outfit in Pas, I left for home on May 18.

I have the honour to be, Sir,

Your obedient servant,

P. B. STREET, D.L.S.

APPENDIX No. 54.

ABSTRACT OF THE REPORT OF A. G. STUART, D.L.S.

RETRACEMENT OF MERIDIAN AND BASE LINES IN MANITOBA AND SASKATCHEWAN.

My work during the past season consisted of the retracement of the second base line from the principal meridian to the second; the east boundary of range 31 west of the principal meridian from the international boundary to the seventh base line; the fifth, sixth and seventh base lines from the east boundary of range 31 west of the principal meridian to the second meridian; the third base line from the principal meridian east to the east boundary of range 7, and the east boundary of range 7 east of the principal meridian from the third base line to the fifth.

These retracements were made to serve as a working base from which to investigate and locate certain errors of previous surveys which were believed to exist.

Levels were taken in connection with the surveys and elevations were established in all the towns along the railways in the vicinity of the work. These levels can easily be reduced to mean sea-level datum and added to the great network of levels already taken over the country, which will some day be used for drainage, reclamations, railway location, highways and other engineering schemes.

Good roads were found almost everywhere in the vicinity of our work. The exceptions were the very rough wooded country in the Pembina mountains, near Swan lake, near Pelican lake and some swamp areas such as that in township 8, range 6, east of the principal meridian. One long stretch of well-graded road, runs from Beausejour to the settlements southeast of lake Winnipeg, passing through a low portion of the country where much drainage has been necessary. This road has probably the heaviest traffic of any rural highway in the West and is of great benefit to the farmers.

The country passed over has a close network of railways making the city market easily available to all farmers.

Pembina mountains in the southern part of Manitoba are a series of hills and deep ravines, heavily wooded with poplar and oak of large and small diameter. There is very little rock, but there is an abundance of blue clay suitable for brick manufacture, and on account of the convenient transportation connections with the large cities, this will some day be of economic value.

At Swan, Pelican and Whitewater lakes, which are in deep ravines and are surrounded by woods, the people from the nereby cities and towns have found pleasant summer resorts.

In that part of southeastern Saskatchewan through which we worked the land is not quite as heavy and rich as in southern Manitoba, but the conditions under which the crops were raised this season seemed very favourable and the harvest was an abundant one, and was marketed early. In this district there are some very prosperous German settlements, such as Langenburg.

The country northeast of Winnipeg is settled by homesteaders from Galicia, who have cleared the land they cultivate of heavy spruce and poplar. Considerable drainage has been done and more will be necessary in order to develop this district to its full extent.

During the winter months large quantities of wood and ties are shipped from railway points south, affording a means of making ready money. The present winter, however, has been so mild with practically no snow, that this industry is almost at a standstill and this has been keenly felt in the local business centres.

The Canadian Northern Railway company has at present the right of way cut for a line extending along the southeast side of lake Winnipeg. This will help to a very marked degree in opening up this portion of the country.

APPENDIX No. 55.

ABSTRACT OF THE REPORT OF C. H. TAGGART, D.L.S.

SURVEYS IN THE KAMLOOPS DISTRICT OF THE RAILWAY BELT, BRITISH COLUMBIA.

On April 11, 1913, I left Ottawa for Kamloops, where I arrived on the 16th. I immediately commenced the organization of my party, which was completed on the 21st. On the morning of the 22nd we started for our first work in townships 19, ranges 14 and 15, and camp was pitched at the west end of Desdero lake.

The Kamloops to Okanagan wagon road runs through this township. At Holmwood post office in section 12, range 15, a branch road leads to the lands surveyed. Many fair pieces of agricultural land are to be found in this township. The settlers already located seem to be meeting with success; their chief crops being grain and hay, with some vegetables. Some good stock ranches are located along the Okanagan wagon road. It would seem that the farmers in this district would meet with greater success by introducing mixed farming on a larger scale, and making a specialty of hogs and poultry.

Our next work took us into township 17, range 13. It is expected by the residents there that the new Canadian Northern Pacific railway from Kamloops to Kelowna, on which it has been announced that construction is to commence this summer, will pass through this district. In anticipation of this fact a large portion of the land suitable for agriculture, has been purchased by a syndicate. The owners are doing little development work and seem to be holding the land simply for higher prices. On this account the district does not show much improvement. Much may be expected from it, however, with the advent of the railway and the breaking up of the large holdings into smaller farms.

Our next work was north of Kamloops lake, in townships 21, ranges 18, 19 and 20. Tranquille river flows through township 21, range 19, but its valley is very narrow and as a result no settlers have as yet located there. Two or three ranches are located higher up the valley, and there is some land under cultivation at the mouth of the river, on Kamloops lake. A new wagon road up Tranquille river is under construction; it follows the western slope of the valley, crossing to the east side in section 27. This road will give access to the country to the north in townships 22, ranges 20 and 21, and will aid very much in opening up this region. The soil on the bench lands on either side of the river, is rocky and dry and produces only a small quantity of grass.

The country in the vicinity of lac du Bois is suitable for dry farming. The soil is rich and areas of sufficient size for homesteading are to be found. A number of persons have already taken up land there and appear to be pleased with their prospects. The road from Kamloops is rather difficult to travel at present but it is said to be the intention of the settlers to try to induce the Provincial Government to improve the old road where the present grades are suitable and make diversions where they are unsuitable.

In July Tranquille river had a flow of 2.5 cubic feet per second. This water is all used in irrigating two ranches on Kamloops lake at the mouth of the stream.

Our next work was at Savona Ferry, at the west end of Kamloops lake. The main line of the Canadian Northern railway is under construction there and follows the north shore of Kamloops lake very closely. The construction of the railway along the lake shore was very expensive on account of the great amount of rock work, which had to be done. It was necessary to construct two tunnels.

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A considerable area adjoining Savona Ferry has been subdivided into building lots, but so far as could be ascertained, there has not been a great demand for these lots. The district west of the mouth of Deadman river is being developed as a fruit growing area, and already many thriving apple orchards may be seen. This land is watered by an irrigation flume which takes water from Deadman river at a point about the middle of township 22, range 22.

We proceeded next to the Semlin valley in township 21, range 24. The valley is very fertile and capable, under irrigation, of producing hay, all kinds of grain and vegetables, and the hardier fruits. The land in this valley, part of which has been taken up since the early days, is at present held by large ranchers. The Hon. Charles Semlin ex-premier of British Columbia, is one of the largest holders. These ranchers have extensive grazing areas, in the Cariboo district, away to the north. Cattle are kept on these ranges during the growing season, and brought to the Semlin valley, to be wintered on the hay which has been put up for them during the summer. When they are in condition to be slaughtered, they are taken to Ashcroft.

We next completed the subdivision of township 21, range 25, which is high rolling range land, and practically uninhabited. It is mostly held under lease by stock owners. The Indian reserve in the middle of the township does not appear to be used by any one.

Our work continued westward into the valley of Hat creek. The best of the bottom lands of this valley have been taken up and used for cattle ranching for many years. On account of the advent of the Pacific and Great Eastern railway which passes within about ten or twelve miles of Hat Creek settlement, this valley is receiving a new impetus. Already a considerable number of additional homesteads have been taken up.

The closing weeks of the season were spent in making surveys near Thompson river in townships 18 and 19. The Canadian Northern Pacific railway follows closely the right bank of the river there. The grade is completed and ready to receive the steel. The railway parallels the old "Cariboo road," about which something of interest may be mentioned here.

This road is one of the original trunk roads of the province. It was built in the early sixties, for the purpose of furnishing a means of transport for the gold seekers who rushed from every corner of the earth, but chiefly from the gold fields of California, into the Cariboo country in the late fifties. The Cariboo road early became a regular route for passenger and mail stages. Later on an express company was formed, known as the British Columbia Express company, but which has always been known as the "B. X." This company operated until a few months ago, carrying His Majesty's mails from Ashcroft to Fort George. These stages are still operated in much the same style as in days gone by. The vehicles are very picturesque. They are drawn by four or six spirited young horses, and make the distance in very quick time. Fresh relays of horses are put in every fifteen miles. Besides the main route to Fort George, express lines run to Lilloet, Barkerville and other points in the interior. During the summer the stage runs north only as far as Soda creek. From there to Fort George passengers and mail are carried by boat up Fraser river.

Within the last few months, however, this historic express company has practically ceased to exist. Last year the Government mail contract was captured by a newly organized company known as the Inland Express company. The original company is understood to have sold the new company all their outfit with the exception of the river boats.

The portion of the "Cariboo road" south from Ashcroft has been used but very little since the completion of the Canadian Pacific railway. As a result the road has been allowed to fall into disrepair and in many places it is now almost impassable. It will always be required as a local road however and it is not probable that it will be allowed to fall into disuse entirely.

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The district in which our work was situated lies within what is known as the "Dry Belt" of British Columbia. This belt is very irregular in shape and extends from the west end of Shuswap lake westerly including the valley of Thompson river to its confluence with Fraser river. It extends a hundred miles or so north of Ashcroft, and includes the Nicola and Okanagan districts to the south. In many places through the Kamloops district, farming can be carried on successfully without irrigation at altitudes varying from two thousand feet to twenty-five hundred feet and over. Of course, even at these altitudes crops are grown successfully only when the principles of dry farming are practised. A remarkable feature about the character of the soil in many localities is that the richer and more productive soils are found at the higher altitudes. In the district about Kamloops the soil at altitudes exceeding twenty-five hundred feet is mostly black loam similar to that found in the prairie provinces. In fact where sufficiently large areas are to be found wheat and other crops are grown as on the prairie and during the last two years when the rainfall has been more copious than usual, with equal success.

At altitudes between three thousand and thirty-five hundred feet summer frosts are of frequent occurrence so that the more tender fruits and garden crops cannot be grown with success. As an altitude of four thousand feet is reached frosts occur throughout the summer and the only dependable crops which can be grown are hay and oats, the latter having to be cut and made into hay before reaching maturity. The soil at these altitudes is usually fertile and the rainfall sufficient.

The country generally is ideal for stock raising and the climate is said to be particularly suitable for horses.

This year weather conditions in the dry belt of British Columbia were excellent for survey operations. Although probably more than the average amount of rain fell during the season it did not hinder our work materially. A considerable portion of the area covered was range land and partly open so that an unusually large area was surveyed.

APPENDIX No. 56.

REPORT OF C. M. WALKER, D.L.S.

MISCELLANEOUS SURVEYS AT BANFF.

BANFF, ALTA., January 28, 1914.

E. DEVILLE, Esq., LL.D.,
Surveyor General,
Ottawa, Canada.

SIR,—I have the honour to submit the following report, with reference to work done by my party during the season of 1913.

On May 12, I began my first work, the resurvey of the cemetery at Banff, Alberta, in the Rocky Mountains park. Only one section of the cemetery had been previously surveyed, though graves were to be found in the other sections, this necessitating considerable re-adjustment.

After the completion of the survey, I proceeded to lay out a cemetery in the vicinity of Bankhead on the eastern slope of Cascade mountain.

In the meantime, I had received instructions from the Department to work in conjunction with the Dominion Parks branch in the laying out and construction of roads, throughout the Rocky Mountains park.

The point at which both location and construction were begun this year, was about three and a half miles west of Banff, on the Banff Castle road. Several years ago, the road was constructed from Banff to this point, but was left in a very unfinished state. A repair gang was engaged on this portion of the road for a great part of the summer, and much work is still needed on it.

We began the final location of the road, from the point mentioned above, and continued westerly in the direction of Castle mountain. As, is to be expected, in a mountainous country, the ground surface is very much broken by ravines, ridges or rocky bluffs, thus making almost constant change in the direction of the road necessary in order that low grades might be maintained. Tangents are necessarily limited to very short distances. The measurements were all taken on the proposed centre line, and stations were placed every one hundred feet and sometimes oftener, as in case of curves where the centre line was staked, every twenty or twenty-five feet; the beginnings and ends of the curves were also marked on the ground. The profile of the centre line was then run and plotted, and the grades having been determined upon, stakes were driven marking the cut and fill. Cross-section stakes were also placed where necessary. Sheets or working sketches of the grade were made and supplied to each foreman of the several gangs employed on the construction.

Having completed the final location of the road from Banff to Castle mountain, a distance of about twenty miles, I next ran a traverse and levels over a right of way which was partially cleared several years ago, from Castle mountain to the boundary between Alberta and British Columbia, in the Vermilion pass. From this point the British Columbia Government have been constructing the road down through the Vermilion pass, to join the road running from Golden to Steele, near Windermere, in the upper Columbia valley. When this road is completed, probably two years hence, there will be thrown open to the tourist, one of the finest scenic routes on the continent.

We next moved to Field, British Columbia, in order to make some small miscellaneous surveys including the laying out of a cemetery. I also traversed the road leading from Field to Emerald lake, while in the neighbourhood.



Photo by H. Matheson, D.F.S.

Bridge across Miette River near Jasper, Alberta

This bridge crosses Miette river about a mile southwest of Jasper and was constructed by the Dominion Parks Branch. The road was made during the construction of the Grand Trunk Pacific railway and afterwards improved by the Dominion Government. Goat trails are seen in the distance.

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This road about seven miles in length, was found to be in very good condition, and it leads to one of the beauty spots in Yoho park, that is, Emerald lake. One view alone of this beautiful lake hidden away at the back of Mount Burgess, surely repays the tourist for the time spent in reaching it.

Our next move was made to Glacier, British Columbia, to do some miscellaneous work in connection with roads. The only wagon road leading out of Glacier, is the one in the direction of Nakimu caves, which are about seven miles distant. The road is somewhat steep for carriages, and has, therefore, been constructed on the southern and western slopes of Mt. Cheops. At present the road does not go right to the caves but has stopped about one-half mile therefrom.

Only two of the caves are open to the public as yet, but surveys were being carried on this summer with a view to opening up the largest of them by means of a tunnel, from the outside, thus making it accessible to visitors at all times of the year. Up to the present time the largest cave just referred to has been accessible only when the stream which runs through it is very low and even then, there has been considerable risk attached. These caves constitute the most interesting spot for the sightseer.

Having traversed the road to the caves and completed the survey of a small parcel of land for private leasehold close to Glacier station, we returned to Castle mountain, Alberta, and began the final location survey of the auto road on the north side of Bow river, from Castle to Laggan, a distance of about eighteen miles. The country is timbered throughout the length of the proposed road, with small jackpine, spruce and scattered fir. As a general rule, however, the timber is so small that it is difficult to obtain proper timbering for the necessary culverts and wooden bridges along the road. Splendid views of the mountains are to be obtained throughout the entire route.

Just at the time when I was completing the location survey of this road I was requested by the Commissioner of Parks, to also make a road survey on the south side of the Bow, from Laggan to Castle in order that a comparison of the two routes could be made as to desirability and respective cost. Accordingly, as soon as I had reached Laggan on the north side, I began the survey of the route on the south side of the Bow, from Laggan back to Castle.

I received instructions from the Department at this time, that Mr. T. H. Mawson, the noted landscape and civic design artist, was proceeding to Banff, in order to make plans for the beautifying of Banff and vicinity, and that the Department wished me to make any surveys which Mr. Mawson might desire for the obtaining of necessary information.

On interviewing him I was informed that ten-foot contours were necessary and that they were needed at once, over an area of about six hundred acres in the villa lot section, on the south side of Bow river at Banff. Consequently about November 1, I was compelled to organize a second party to carry on the work in this connection. This party was kept busy for one month. On the completion of the survey of the road from Laggan to Castle on the south of the Bow, I moved the party to Banff, where we were engaged in making various surveys in the villa lot section. I then made a survey of the new golf course enlarging the old one sufficiently to make the grounds suitable for an eighteen link course.

A small parcel of land was also surveyed in section 29, township 25, range 12, west of the fifth meridian for purposes of picnic grounds, to be reached by a motor launch, from Banff.

Throughout the whole season, it was necessary to keep in constant touch with the construction work, on the various roads for the purpose of setting bridge levels, grades, etc.

Having completed the work for which I had received instructions I disbanded my party for the season on December 16, storing the outfit at Banff.

I have the honour to be, Sir,

Your obedient servant,

O. M. WALKER, D.L.S.

APPENDIX No. 57.

ABSTRACT FROM THE REPORT OF B. W. WAUGH, D.L.S.

MERIDIAN AND BASE LINE SURVEY IN NORTHERN MANITOBA.

My work during the season of 1913-14 consisted of the survey of part of the principal meridian from townships 73 to 80 inclusive and parts of the twentieth and twenty-first base lines.

The party having been organized, and the necessary outfit obtained, we left Selkirk for Warren's landing on May 24, 1913, one-half of the party on the *S.S. Mikado* and the remainder on the *S.S. Wolverine*. The southern end of lake Winnipeg was then completely free of ice, but towards the northern end we encountered large cakes of rotten ice miles in extent. From Warren's landing we travelled to Norway House on the tug *Highlander*, and from there by canoe down Nelson river to Cross portage, and thence to Landing lake where our work commenced.

On June 11 work was started on the principal meridian at the northeast corner of section 24, township 72 and continued steadily until August 22 when the northeast corner of section 13, township 80 was reached. During this time we had succeeded in getting only a small portion of our supplies down Nelson river from Norway House, the Hudson's Bay company, on whom we were depending for our transportation, having difficulty in obtaining the necessary help from the Indians. It was deemed advisable, therefore, on account of the short season then left for navigation, that we freight our own winter supplies by canoe, and consequently we left camp for Norway House on August 26, arriving there on September 6. The canoes were loaded and started for Split lake on the following Monday. I took advantage of this opportunity to go to Selkirk to purchase dogs for the winter work.

By this time McMillan Bros. had completed a transportation route from Whiskey Jack portage, between Playgreen lake and Cross lake, to Shoal falls on the Nelson, about eight miles below Cross lake, and then were engaged in laying a pole track from there to the southwest end of Sipiwesk lake. This afforded us great assistance in our transportation, as we were able to get the remainder of our supplies to Whiskey Jack by the tug *Highlander*, across this portage by McMillan Bros'. teams and thence to Shoal falls by means of their barge. From Shoal falls our canoes took their next load of supplies to Partridge Crop lake on the twentieth base-line, where I left one man to mind cache and fish for dog-feed. The remainder of our supplies, with the exception of the dog-biscuit, we succeeded in getting across McMillan's pole track to Sipiwesk lake and from there to Split lake by our own canoes, where we were frozen in on October 19, small sluggish creeks having frozen over as early as October 12. It then became necessary for us to build hand sleighs to move our supplies and camp equipment to the end of the meridian in township 80, and work was commenced on the line again on November 10. On the 11th the twenty-first base line east of the principal meridian was turned off and produced to the end of range 9 by January 21, 1914. We then moved to the twentieth base line completing the seven ranges east of the meridian on March 9 and the three ranges west of the meridian on March 27.

During the summer canoes and man-packing were our means of transportation while in the winter dogs were used.

This summer it is the intention of McMillan Bros. to put a launch and a barge on Sipiwesk lake to run from the north end of their pole track on this lake to Manitou rapids. This will afford the best means of transport to Manitou rapids until the Hudson Bay railway is completed to that place.

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General description of the country.

In crossing Landing lake, in which the northeast corner of township 72, range 1, falls, the meridian passes from a country in which rock outcroppings is the prominent feature into a clay belt; this continues as far north as township 80, the rock becoming gradually less frequent. The clay belt is rolling, with swampy valleys, and the soil is clay and clay loam. In most cases the swampy valleys would be quite easily drained into the different rivers and lakes. The hills and ridges become higher to the northward, until in township 80 they reach a height of about two hundred feet. The ridges and valleys lie in a northeasterly and southwesterly direction.

Along the twenty-first base line the clay belt continues but the country is more level east of Burntwood river and is, although fairly dry, much more swampy than that previously passed. In ranges 8 and 9 the country becomes more of the muskeg variety and to the east, south and southwest of these ranges it appears to be almost continuous muskeg with occasional jackpine ridges.

The twentieth base line to the east in range 1 passes through Partridge Crop lake and the remainder of the line passes through country with a good clay loam soil. The country is rolling with some muskeg of considerable extent. In range 7 on the east side of the Nelson the country becomes more swampy, and farther east appears to drop into the regular muskeg country.

Westward from the principal meridian on the twentieth base line the rock more nearly approaches the surface and in some cases bald rocks appear. The country consists of long ridges running in a northeasterly and southwesterly direction with broad deep valleys intervening.

Description of the principal lakes and rivers.

In section 1, township 73, range 1, the meridian crosses Landing lake, a long narrow body of water about three-quarters of a mile wide and thirty miles long. The lake is very deep and whitefish are plentiful.

Wintering lake, crossing townships 73, 74 and 75, range 2, west, Partridge Crop lake along the twentieth base line, Natawahunan lake in township 78, range 3, east and Armstrong lake in township 78, range 4, east are all well stocked with fish, the principal variety of value being whitefish. The species caught in these lakes, although inferior to the lake Winnipeg whitefish, are of good quality and no doubt, in the near future when the transportation in this country is benefited by the Hudson Bay railway, fishing stations will be established there. Small patches of timber consisting of spruce from six to ten inches in diameter, are found on some of the points on the shores of these lakes. Landing lake, Wintering lake, Partridge Crop lake and Armstrong lake and river appear to lie on rock contact depressions; the only indications of mineral however are seen in pegmatite veins which cut the granite containing pyrite, muscovite, some amber mica, chalcopyrite and molybdenum in small quantities. Some quartz veins were observed on Natawahunan lake, but in nearly all cases were found barren. A number of discovery claims have been "staked" in these places.

In section 12, township 80 the meridian crosses Burntwood river, and this river is again crossed three times by the twenty-first base line in ranges 2 and 3. Its banks are clay about fifty feet high, with occasional rock outcroppings. On the lower portion there are only three falls, the river being mostly wide and the current slow but the upper part has many rapids.

Odei river, crossing the twenty-first base line in ranges 1 and 2, east is a tributary of Bruntwood river, and is most remarkable for the straightness of the fifteen miles nearest its mouth. Its banks are from one hundred to two hundred feet high on the lower part and very low and swampy in the upper part. Over a stretch of three miles in section 2, township 81, range 1 and sections 35, 36 and 25, township 80, range 1,

there is a drop of nearly one hundred feet affording good water-power but the lower part of this river is free from rapids. Whitefish and sturgeon are to be found in this river.

In range 5 the twenty-first base line crosses Witchai lake, a large shallow L-shaped body of water in which whitefish are plentiful. This lake as well as Natawahunan and Partridge Crop lakes are merely enlarged options of Grass river which empties into Split lake. That portion of Grass river between Natawahunan lake and Split lake is very shallow and contains many rapids, making it a very poor canoe route.

Split lake which is an enlargement of Nelson river is a large body of water about twenty miles long and from ten to fifteen miles wide. It has a very uneven rocky shore line making many long narrow bays, and contains many islands, hence in some places the current is strong causing heavy seas in certain winds. The whitefish in this lake are small and not plentiful.

The winter trail from Split lake to Norway House runs along this river to Natawahunan lake where it turns to the south, going overland to Landing lake and thence over Cross portage to Sipiwesk lake. Another route is to go up Grass river through Partridge Crop lake to Wintering lake, and thence by way of Thicket portage, Landing lake and Fiddle river to Sipiwesk lake.

The proposed line of the Hudson Bay railway crosses the meridian in township 74, and the twentieth base line in range 3, east of the principal meridian. Along this railway line McMillan Bros. have a winter road cut as far north as mile 290.

No timber or minerals of value were found except those already mentioned. The timber throughout the country is invariably small spruce, jackpine and poplar on the ridges, and small spruce, tamarack and birch in the valleys.

Whitefish are plentiful in most of the larger lakes and rivers, and in Grass, Odei and Nelson rivers sturgeon are to be found.

In the fall during freeze-up caribou pass through the country around Split lake in herds, and it is a common occurrence to hear of one man shooting as many as thirty in one day. The Indians depend largely on these caribou for their winter supply of meat for themselves and their dogs. Moose are plentiful in Natawahunan lake district and a few bears are to be found there. Foxes are the chief fur-bearing animals of the district but mink, bob-cat, wolves and others are also plentiful.

The summer in this country appears to be very short, the snow leaving about the latter part of April and coming again in October. Last summer was very wet and cold and during August we had several frosts. Towards the end of the winter the snow became very deep, being from three to three and a half feet. The winters are extremely cold, the average minimum temperature often being about forty degrees below zero for a period of four to six weeks.

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APPENDIX No. 58.

RESULTS OF MAGNETIC OBSERVATIONS.

TABLE I. DECLINATION OBSERVATIONS.

Place.	Township.	Range.	Meridian.	Date.	Declination	Observer.
44°00 N.-NE. cor. sec. 22	16	6	E. pr.	Oct. 4, '13	12 27.8	C. F. Aylsworth.
5°00 N.-	18	15	"	Dec. 27, '13	9 29.7	G. A. Bennett.
5°00 N.-	18	15	"	" 27, '13	30.9	"
30°00 S.-	36	15	"	July 6, '13	11 05.2	W. J. Deans.
30°00 S.-	36	15	"	" 6, '13	06.8	"
30°00 S.-	36	15	"	" 7, '13	02.8	"
30°00 S.-	36	15	"	" 6, '13	09.7	"
20°00 S.-	33	15	"	" 20, '13	9 28.1	"
20°00 S.-	33	15	"	" 20, '13	10.1	"
20°00 S.-	33	15	"	" 20, '13	22.1	"
20°00 S.-	33	15	"	" 20, '13	32.6	"
0°65 S.-	32	15	"	" 26, '13	6 05.7	"
0°65 S.-	32	15	"	" 26, '13	5 51.6	"
1°00 N.-	32	15	"	" 27, '13	6 09.1	"
1°00 N.-	32	15	"	" 27, '13	08.4	"
78°68 W.-	35	68	1 Pr.	June 11, '13	17 31.6	G. H. Herriot.
59°97 W.-	35	68	1	" 12, '13	15 15.0	"
60°94 W.-	32	68	1	" 17, '13	14 23.4	"
44°60 W.-	36	68	2	" 19, '13	15 30.1	"
59°80 W.-	35	68	2	" 21, '13	16 12.2	"
At	36	72	2	Aug. 16, '13	16 19.2	"
55°91 W.-NE	32	72	2	" 23, '13	20 17.6	"
60°00 N.-	35	20	3	Nov. 5, '13	13 52.1	C. F. Aylsworth.
35°00 N.-	4	21	3	Oct. 29, '13	30.9	"
At	18	21	3	Nov. 7, '13	35.8	"
At	22	21	3	" 11, '13	50.1	"
At	34	21	3	" 13, '13	38.4	"
At	21	21	3	" 17, '13	45.9	"
20°00 N.-NE cor. sec. 19	21	3	Pr.	Nov. 25, '13	13 38.8	C. F. Aylsworth.
60°00 N.-	30	21	3	" 25, '13	38.7	"
At	29	21	3	" 27, '13	42.5	"
At	20	21	3	" 26, '13	32.4	"
At	32	21	3	" 29, '13	42.8	"
10°00 E.-	36	28	3	Mar. 8, '13	12 59.9	W. J. Deans.
10°00 E.-	36	28	3	" 9, '13	56.8	"
11°95 W.-	31	68	3	July 4, '13	18 22.9	G. H. Herriot.
27°77 W.-	35	72	3	Aug. 28, '13	15 37.6	"
8°13 W.-	34	72	3	" 29, '13	14 08.0	"
48°00 N.-	35	21	4	June 27, '13	13 32.8	C. F. Aylsworth.
30°00 N.-	12	22	4	" 23, '13	40.7	"
At	26	22	4	" 24, '13	53.6	"
At	4	22	4	" 26, '13	26.0	"
At	3	22	4	" 27, '13	37.2	"
At	9	22	4	" 27, '13	30.1	"
At	1	22	4	" 27, '13	21.7	"
At	3	22	4	" 27, '13	26.1	"
At	18	22	4	July 2, '13	16.1	"
20°00 W.-	30	22	4	" 4, '13	14.4	"
40°00 N.-	8	22	4	" 5, '13	31.5	"
At	20	22	4	" 9, '13	33.7	"
At	29	22	4	" 11, '13	30.1	"
At	21	22	4	" 17, '13	37.4	"
55°00 N.-	22	22	4	" 22, '13	43.7	"
At	3	22	4	June 18, '13	34.7	"
15°00 N.-	26	28	4	Mar. 5, '13	12 55.7	W. J. Deans.
15°00 N.-	26	28	4	" 6, '13	59.1	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.			Township.	Range.	Meridian.	Date.	Declination	Observer.
							° ' "	
56°53 W.-	"	35.....	68	4	"	July 10, '13	16 37.5	G. H. Herriot.
27°40 W.-	"	36.....	72	4	"	Sept. 5, '13	14 32.8	"
25°55 W.-	"	35.....	72	4	"	" 6, '13	14.2	"
20°00 W.-	"	31.....	72	4	"	" 10, '13	02.5	"
At	"	4.....	23	5	"	Aug. 20, '13	15 32.7	C. F. Aylsworth.
At	"	16.....	23	5	"	" 21, '13	31.3	"
55°00 N.-NE cor. sec. 8	"	.....	23	5	Pr.	Aug. 25, '13	13 27.8	C. F. Aylsworth.
At	"	30.....	23	55	"	" 29, '13	36.8	"
At	"	21.....	23	5	"	Sept. 1, '13	28.2	"
At	"	26.....	23	5	"	" 12, '13	49.5	"
10°00 N.-	"	23.....	23	5	"	" 8, '13	59.1	"
At	"	36.....	28	5	"	Feb. 28, '13	07.6	W. J. Deans.
At	"	36.....	28	5	"	Mar. 2, '13	08.6	"
At	"	36.....	28	5	"	" 3, '13	04.9	"
39°05 W.-	"	32.....	68	5	"	July 28, '13	18 20.8	G. H. Herriot.
6°97 W.-	"	35.....	72	5	"	Sept. 14, '13	13 20.3	"
72°00 W.-	"	36.....	29	6	"	Feb. 22, '13	13 09.9	W. J. Deans.
7°00 "	"	36.....	29	6	"	" 23, '13	10.4	"
10°00 S.-	"	36.....	29	6	"	" 20, '13	13 11.6	"
30°00 W.-	"	36.....	29	6	"	" 21, '13	00.0	"
60°55 W.-	"	34.....	68	6	"	Aug. 6, '13	19 24.1	G. H. Herriot.
53°73 W.-	"	33.....	72	6	"	Oct. 1, '13	18 10.5	"
20°00 W.-	"	32.....	72	6	"	" 2, '13	16 52.7	"
50°00 N.-SE	"	1.....	31	7	"	Feb. 16, '13	13 49.3	W. J. Deans.
"	"	1.....	31	7	"	" 17, '13	53.8	"
"	"	1.....	31	7	"	" 18, '13	55.7	"
67°71 W.-NE	"	33.....	64	7	"	July 1, '13	16 29.7	O. Rolfson.
49°90 W.-	"	35.....	68	7	"	Oct. 29, '13	15 15.4	G. H. Herriot.
21°10 W.-	"	32.....	68	7	"	Nov. 1, '13	14 52.6	"
2°99 W.-	"	31.....	68	7	"	" 3, '13	15 23.7	"
16°77 W.-	"	32.....	64	8	"	July 10, '13	15 13.0	O. Rolfson.
19°82 W.-	"	33.....	68	8	"	Nov. 6, '13	17 00.2	G. H. Herriot.
40°00 W.-	"	15.....	25	9	"	Dec. 16, '13	13 21.6	G. A. Bennett.
12°00 W.-¼ cor. E by sec. 22	"	.....	25	9	"	" 18, '13	24.4	"
60°48 W.-NE cor. sec. 34	"	.....	60	9	"	Jan. 1, '13	16 49.0	O. Rolfson.
29°40 W.-	"	32.....	64	9	"	July 15, '13	14 49.5	"
72°57 W.-	"	34.....	68	9	"	Nov. 12, '13	13 11.3	G. H. Herriot.
52°65 W.-	"	35.....	64	10	"	July 18, '13	13 42.9	O. Rolfson.
27°96 W.-	"	35.....	64	10	"	" 21, '13	46.8	"
27°96 W.-NE cor. sec. 35	"	.....	64	10	Pr.	July 21, '13	13 49.7	O. Rolfson.
61°95 W.-	"	31.....	64	10	"	" 24, '13	16 53.5	"
0°18 W.-	"	36.....	68	10	"	Nov. 15, '13	15 11.9	G. H. Herriot.
4°20 W.-	"	34.....	68	10	"	" 18, '13	12 07.0	"
4°14 W.-	"	33.....	64	11	"	July 30, '13	21 02.4	O. Rolfson.
56°27 W.-	"	31.....	68	11	"	Nov. 28, '13	17 13.6	G. H. Herriot.
70°00 W.-SE	"	6.....	23	12	"	Jan. 1, '13	14 36.1	W. J. Deans.
24°03 W.-NE	"	31.....	60	12	"	Feb. 1, '13	15 49.4	O. Rolfson.
16°63 W.-	"	32.....	64	12	"	Aug. 5, '13	19 01.9	"
36°00 W.-	"	35.....	68	12	"	Dec. 1, '13	16 29.4	G. H. Herriot.
74°95 W.-	"	34.....	68	12	"	" 2, '13	17 51.5	"
30°00 S.-	"	2.....	23	13	"	Jan. 2, '13	15 09.7	W. J. Deans.
52°90 W.-	"	32.....	60	13	"	Feb. 3, '13	18 05.7	O. Rolfson.
52°90 W.-	"	32.....	60	13	"	" 3, '13	24.7	"
12°34 W.-	"	33.....	64	13	"	Aug. 9, '13	16 44.5	"
12°34 W.-	"	33.....	64	13	"	" 9, '13	44.7	"
4°00 W.-	"	33.....	68	13	"	Dec. 9, '13	16 03.6	G. H. Herriot.
76°75 W.-	"	33.....	68	13	"	" 1, '13	17 06.5	"
70°00 W.-	"	7.....	33	14	"	Jan. 15, '13	15 14.1	W. J. Deans.
19°16 W.-	"	36.....	60	14	"	Feb. 6, '13	22 14.5	O. Rolfson.
67°00 W.-	"	34.....	60	14	"	" 8, '13	17 17.1	"
67°00 W.-	"	34.....	60	14	"	" 8, '13	13.4	"
67°00 W.-	"	34.....	60	14	"	" 8, '13	12.5	"
59°70 W.-	"	35.....	64	14	"	Aug. 21, '13	16 48.0	"
17°00 N.	"	8.....	29	15	"	Nov. 19, '13	13 59.6	R. C. Purs
At ¼ cor. N. by sec. 9	"	29	15	"	" 22, '13	59.6	"

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RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At NE cor. sec. 36	33	15	"	June 25, '12	15 56.1	T. H. Plunkett.
75.00 S.-	"	15	"	Jan. 13, '13	14 59.6	W. J. Deans.
76.00 S.-	"	3	"	" 14, '13	15 35.0	"
35.59 S.-	"	13	"	June 27, '12	51.8	T. H. Plunkett.
5.44 N.-	"	25	"	" 30, '12	17 03.9	"
56.57 W.-	"	35	"	Feb. 14, '13	16 44.4	O. Rolfson.
4.49 W.-	"	35	"	" 17, '13	10.4	"
4.40 W.-NE cor. sec. 35	60	15	Pr.	Feb. 17, '13	16 09.1	O. Rolfson.
1.53 W.-	"	31	"	" 17, '13	41.8	"
1.53 W.-	"	31	"	" 17, '13	43.8	"
50.47 W.-	"	32	"	Aug. 27, '13	17 42.2	"
48.00 W.-	"	33	"	Dec. 25, '13	16 55.0	G. H. Herriot.
38.00 W.-	"	32	"	" 26, '13	48.1	"
0.73 W.-	"	34	"	Feb. 25, '13	27 28.6	O. Rolfson.
0.73 W.-	"	34	"	" 25, '13	28.1	"
15.00 W.-	"	34	"	Dec. 31, '13	20 15.0	G. H. Herriot.
77.70 W.-	"	32	"	Mar. 5, '13	18 16.8	O. Rolfson.
8.85 W.-	"	35	"	Sept. 12, '13	16 44.6	"
56.00 E.-	"	34	"	Feb. 13, '13	17 45.4	T. H. Plunkett.
30.00 E.-	"	36	"	" 14, '13	46.0	"
23.50 W.-	"	33	"	Mar. 10, '13	18 11.2	O. Rolfson.
23.50 W.-	"	33	"	" 10, '13	11.8	"
61.05 W.-	"	34	"	Sept. 24, '13	19 09.6	"
19.95 W.-	"	32	"	" 25, '13	27.3	"
At	"	33	"	Feb. 5, '13	18 16.4	T. H. Plunkett.
63.00 E.-	"	35	"	" 8, '13	27.3	"
63.00 E.-	"	35	"	" 8, '13	27.0	"
18.05 W.-	"	34	"	Mar. 14, '13	33.0	O. Rolfson.
18.05 W.-	"	34	"	" 14, '13	31.9	"
56.54 W.-	"	31	"	Oct. 1, '13	17 36.9	"
30.00 E.-NW	30	1	"	Nov. 22, '13	14 44.1	W. J. Deans.
8.00 E. Wit. M-marked 7.78 N.-NE.						
cor. sec. 33.	17	20	"	June 12, '13	14 51.6	G. A. Bennett.
"	33	20	"	" 12, '13	52.2	"
"	33	20	"	" 12, '13	55.9	"
"	33	20	"	" 12, '13	53.1	"
79.00 E.-NE. cor. sec. 33	40	20	"	Jan. 31, '13	19 31.5	T. H. Plunkett.
16.67 W.-	"	32	"	Mar. 21, '13	15.2	O. Rolfson.
60.03 W.-	"	31	"	" 23, '13	18 44.8	"
60.03 W.-	"	31	"	" 23, '13	46.1	"
60.00 W.-	"	18	"	June 20, '13	15 48.2	G. A. Bennett.
18.65 E.-	"	32	"	Jan. 24, '13	17 23.1	T. H. Plunkett.
14.00 E.-	"	33	"	" 27, '13	02.1	"
43.00 E.-	"	31	"	Mar. 21, '13	11.9	"
11.41 E.-	"	33	"	" 22, '13	07.3	"
60.20 W.-	"	32	"	" 26, '13	18 17.1	O. Rolfson.
60.20 W.-	"	32	"	" 26, '13	17.7	"
16.00 N.-	"	24	"	June 20, '13	16 01.2	G. A. Bennett.
53.00 E.-	"	34	"	Jan. 14, '13	20 06.3	T. H. Plunkett.
51.00 E.-	"	31	"	Mar. 17, '13	17 29.3	"
36.00 E.-	"	32	"	" 18, '13	17.2	"
18.30 W.-	"	31	"	" 30, '13	18 00.0	O. Rolfson.
18.30 W.-	"	31	"	" 30, '13	17 58.6	"
70.71 E.-	"	36	"	Jan. 8, '13	17 52.6	T. H. Plunkett.
62.00 E.-	"	34	"	Mar. 13, '13	16 56.6	"
14.30 W.-	"	36	"	" 31, '13	18 06.7	O. Rolfson.
30.00 W.-	"	35	"	Dec. 11, '13	16 40.3	W. J. Deans.
10.00 S.-	"	35	"	" 12, '13	4.6	"
28.00 E.- $\frac{1}{4}$ cor. N. by sec. 31	40	24	"	" 30, '12	17 07.9	T. H. Plunkett.
60.00 W.-NE cor. sec. 36	40	24	"	Jan. 6, '13	10.3	"
55.00 W.-	"	31	"	Dec. 9, '13	18.4	W. J. Deans.
40.60 W.-	"	32	"	April 3, '13	50.5	O. Rolfson.
40.60 W.-	"	32	"	" 3, '13	58.3	"
At	"	36	"	Dec. 8, '13	01.5	W. J. Deans.

RESULTS OF MAGNETIC OBSERVATIONS *Continued.*

TABLE I. DECLINATION OBSERVATIONS *Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At 35	40	25	"	" 19, '13	16 48.6	"
15.00 S.	41	25	"	" 8, '13	16 51.0	"
At 35	41	25	"	Mar. 9, '13	17 48.6	T. H. Plunkett.
80.00 E.	57	25	"	Jan. 27, '13	19 24.2	E. W. Berry.
60.00 E.	57	25	"	" 28, '13	17 35.6	"
5.00 N.-	57	25	"	Feb. 3, '13	19 10.8	"
42.00 E.-	57	25	"	" 10, '13	19 19.5	"
40.00 N.-	57	25	"	" 12, '13	17 52.2	"
50.00 N.-	57	25	"	" 13, '13	38.4	"
20.00 W.-NE cor. sec. 34	57	25	Pr.	Feb. 17, '13	19 09.8	E. W. Berry.
8.00 N.-	57	25	"	" 17, '13	17 55.4	"
43.00 W.	57	25	"	" 18, '13	19 50.6	"
20.00 S.-	57	25	"	" 19, '13	20 58.4	"
10.00 N.-	57	25	"	" 21, '13	29.5	"
45.00 N.-	57	25	"	" 24, '13	18 07.7	"
65.00 E.-	57	25	"	" 27, '13	15 43.5	"
60.00 N.-	57	25	"	" 28, '13	16 58.9	"
65.00 E.-	57	25	"	Mar. 1, '13	19 05.1	"
60.00 N.-	57	25	"	" 3, '13	15 46.9	"
50.00 N.-	57	25	"	" 5, '13	21 32.5	"
35.00 N.-	57	25	"	" 12, '13	18 59.2	"
50.00 N.-	57	25	"	" 13, '13	19 56.5	"
14.03 W.-	60	25	"	April 4, '13	17 59.1	O. Rolfson.
14.03 W.-	60	25	"	" 4, '13	18 04.7	"
35.00 N.-	58	26	"	Jan. 16, '13	18 50.2	E. W. Berry.
75.00 E.-	58	26	"	" 17, '13	19 03.7	"
42.00 N.-	58	26	"	" 18, '13	18 38.8	"
7.36 W.-	60	26	"	Nov. 13, '13	17 25.7	O. Rolfson.
61.83 W.-	60	27	"	" 20, '13	19 01.1	"
16.90 W.	60	28	"	" 22, '13	21 27.5	"
60.14 W.-	60	29	"	Dec. 1, '13	20 16.2	"
At 1/4 cor. E. by sec. 5.	33	31	"	June 19, '13	16 01.4	R. C. Purser.
32.41 E.-NE cor. sec. 31	52	31	"	April 3, '12	19 19.7	T. H. Plunkett.
50.52 E.-	52	31	"	" 4, '12	20 33.1	"
50.52 E.-	52	31	"	" 4, '12	19.7	"
1.02 W.-	48	1	2	Mar. 23, '12	19 57.0	"
1.02 W.-	48	1	2	" 23, '12	56.7	"
19.30 W.-	48	2	2	May 2, '13	20 36.9	"
43.24 W.-	48	2	2	" 16, '13	19 42.2	"
69.59 W.-	48	3	2	" 22, '12	20 19.3	"
At 1/4 cor. E. by sec. 29	25	4	2	Dec. 23, '13	18 07.7	R. C. Purser.
10.00 W. 13.00 N.-NE cor. sec. 18, Sta. 16, Lake traverse.	25	4	2	" 21, '13	18 04.1	"
20.00 N.-NE cor. sec. 4	11	6	2	" 13, '13	39.5	G. A. Bennett.
28.00 S.-	10	8	2	Nov. 5, '13	03.5	"
28.00 S.-	10	8	2	" 5, '13	04.6	"
At 27	19	8	2	Oct. 31, '13	19 23.7	"
40.02 W.-	45	9	2	June 21, '13	20 46.7	C. F. Miles.
40.02 W.-	45	9	2	" 14, '13	36.9	"
40.02 W.-	45	9	2	" 21, '13	37.8	"
5.00 E.-	45	9	2	" 13, '13	36.9	"
5.00 E.-	45	9	2	" 13, '13	28.8	"
At 31	6	10	2	July 17, '13	18 04.9	G. A. Bennett.
40.00 W.	7	10	2	" 9, '13	17 45.3	"
40.00 E.	7	10	2	" 10, '13	45.6	"
20.00 E.-	7	10	2	" 16, '13	18 11.7	"
20.00 E.-	7	10	2	" 16, '13	11.6	"
6.50 E.-	20	10	2	" 23, '13	19 02.6	"
40.00 E.-	48	10	2	Oct. 9, '13	37.3	W. J. Deans.
25.00 N.-	48	10	2	" 10, '13	52.2	"
At NE	48	10	2	" 12, '13	20 08.0	"
50.00 W.-	48	10	2	" 13, '13	19 27.2	"
25.00 N.-SE	48	10	2	" 14, '13	46.6	"
At NE	48	10	2	" 16, '13	52.9	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
70°00 N.-SE cor. sec. 26.....	48	10	2	Oct. 17, '13	57.8	W. J. Deans.
20°00 N.-NE " 26	48	10	2	" 20, '13	20 33.0	"
At " 21.....	48	10	3	" 21, '13	19 58.0	"
5°00 S.- " 20	48	10	2	" 22, '13	56.9	"
At " 21.....	26	11	2	June 13, '13	18 08.9	R. C. Purser.
At " 21.....	26	11	2	" 15, '13	05.7	"
At ¼ cor. E. by sec. 28.....	33	11	2	Dec. 1, '13	44.0	"
17°32 W.-¼ cor. N. by sec. 22.....	33	11	2	" 2, '13	47.1	"
14°99 S.-NE cor. sec. 27	33	11	2	" 3, '13	48.4	"
15°00 S.-¼ cor. E. by sec. 28.....	33	11	2	" 4, '13	49.1	"
At ¼ cor. E. by sec. 2.....	33	11	2	Dec. 8, '13	18 47.6	R. C. Purser.
28°50 E. 31°00 N.-NE cor. sec. 2, Sta. 11, Lake traverse	33	11	2	" 10, '13	48.9	"
11°50 N. 4°00 W.-SE cor. sec. 1, Sta. 4, Lake traverse.....	33	11	2	" 12, '13	19 21.6	"
29°30 E.-NE cor. sec. 8.....	20	12	2	" 10, '13	18 48.7	G. A. Bennett.
At " 31.....	47	14	2	July 26, '13	22 33.2	R. C. Purser.
30°00 N.- " 18	42	16	2	June 6, '13	19 31.0	"
10°00 E.- " 31.....	13	18	2	Nov. 10, '13	17 55.8	G. A. Bennett.
At " 22.....	40	18	2	" 19, '13	20 10.0	R. Neelands.
At Sta. 4, sec. 16	7	19	2	Sept. 15, '13	18 24.9	C. Rinfret.
39°00 N.-NE cor. sec. 8.....	23	19	2	Oct. 13, '13	19 23.9	B. H. Segre.
40°00 W.- " 22.....	25	19	2	" 23, '13	35.5	"
At Sta. 2, sec. 33.....	4	20	2	" 11, '13	17 07.0	C. Rinfret.
" 33.....	4	20	2	" 12, '13	10.3	"
At Sta. 3, sec. 22	5	20	2	Sept. 25, '13	18 02.3	"
" 22.....	5	20	2	" 26, '13	17 56.0	"
At Sta. 4, sec. 31.....	7	20	2	Nov. 13, '13	18 36.3	"
At Sta. 78A sec. 6.....	3	21	2	Sept. 11, '13	03.6	"
At Sta. 2, sec. 24.....	3	21	2	Oct. 12, '13	17 45.1	"
At Sta. 3, sec. 22	4	21	2	" 15, '13	54.4	"
" 22.....	4	21	2	" 21, '13	57.0	"
At Sta. 3, sec. 15.....	5	21	2	" 1, '13	46.5	"
At Sta. 2, sec. 10.....	6	21	2	" 31, '13	18 07.9	"
At Sta. 3, sec. 18.....	7	21	2	" 31, '13	19.1	"
" 18	7	21	2	Nov. 6, '13	16.0	"
At Sta. 2, sec. 23.....	2	22	2	Sept. 6, '13	32.6	"
At Sta. 12, sec. 28.....	5	22	2	Aug. 16, '13	45.7	"
At Sta. 6, sec. 28.....	5	22	2	" 22, '13	52.4	"
At Sta. 2, sec. 17	6	22	2	" 28, '13	40.3	"
"	6	22	2	" 30, '13	38.3	"
15°00 N.-NE cor. sec. 9.....	20	22	2	May 22, '13	19 59.0	B. H. Segre.
19°00 S. 14°00 W.-NE cor. sec. 19.....	21	22	2	Dec. 18, '13	54.0	"
At NE cor. sec. 32.....	25	22	2	Nov. 8, '13	19 47.2	"
2°00 E.- " 17	44	22	2	Dec. 1, '13	21 17.9	R. Neelands.
0°60 E.- " 20	44	22	2	" 3, '13	16.8	"
40°00 N.- " 14.....	3	23	2	Aug. 11, '13	19 03.1	C. Rinfret.
At Sta. 3, sec. 29	6	23	2	Nov. 8, '13	18.4	"
40°00 W.-NE cor. sec. 35.....	21	23	2	Sept. 27, '13	20 09.2	B. H. Segre.
22°00 W.- " 32	22	23	2	" 7, '13	10.6	"
" 32.....	22	23	2	" 11, '13	07.4	"
40°00 S. } NE " 22.....	22	23	2	Dec. 5, '13	03.0	"
21°00 E. }						
16°00 S.- " 31.....	23	23	2	Nov. 26, '13	20 05.5	"
At " 21.....	38	23	2	July 6, '13	19 40.1	R. Neelands.
1°60 S.- " 22.....	39	23	2	" 15, '13	25.8	"
40°00 S.- " 30.....	39	23	2	" 16, '13	48.8	"
Sta. 3, Traverse Lake No. 9.....	39	23	2	" 28, '13	20 20.3	"
40°00 S.-NE cor. sec. 2	40	23	2	" 22, '13	21.3	"
39°54 W.- " 9	40	23	2	" 26, '13	24.5	"
51°00 W.- " 34	40	23	2	" 30, '13	45.4	"
8°00 SE- " 15	41	23	2	Aug. 18, '13	11.6	"
At Sta. 7, sec. 5	7	24	2	June 10, '13	18 00.1	C. Rinfret.
" 5.....	7	24	2	" 13, '13	48.3	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
37°00 S.-NE cor. sec. 11.....	18	24	2	May 24, '13	19 33.2	B. H. Segre.
At " 24.....	23	24	2	Sept. 5, '13	20 16.5	"
9°00 W.- " 33.....	24	24	2	Aug. 25, '13	17.3	"
40°00 W.- " 32.....	25	24	2	" 15, '13	19.5	"
36°00 W.- " 11.....	25	24	2	Nov. 17, '13	17.8	"
At ¼ cor. E. by sec. 19.....	27	24	2	July 31, '13	49 54.3	R. C. Purser.
6°50 N.-NE cor. sec. 10.....	27	24	2	Aug. 6, '13	20 30.9	B. H. Segre.
30°00 S.- " 11.....	28	24	2	July 21, '13	07.2	"
At " 4.....	39	24	2	Oct. 27, '13	19 57.0	R. Neelands.
40°00 S.- " 2.....	40	24	2	July 5, '13	20 02.5	"
At Sta. 3, Traverse lake No. 1...	41	24	2	June 27, '13	20 21.1	R. Neelands.
29°00 N.- NE. cor. sec. 24.....	42	24	2	Oct. 8, '13	28.4	"
At " 11.....	44	24	2	Dec. 13, '13	12.4	"
At Sta. 62, sec. 15.....	5	25	2	June 18, '13	18 35.8	C. Rinfret.
27°00 N.-						
22°00 W.-NE. cor. sec. 8.....	19	25	2	" 2, '13	20 16.8	B. H. Segre.
40°00 S.- " 28.....	26	25	2	July 16, '13	41.6	"
16°00 E.- " 12.....	39	25	2	Nov. 2, '13	53.9	R. Neelands.
At Sta. 7, Traverse lake No. 1...	40	25	2	May 27, '13	56.3	"
At NE.- cor. sec. 20.....	41	25	2	June 7, '13	12.2	"
At Sta. 2, Sec. 18.....	4	26	2	Aug. 1, '13	18 08.1	C. Rinfret.
" 18.....	4	26	2	" 4, '13	10.4	"
At Sta. 5, sec. 35.....	5	26	2	June 2, '13	17 57.3	"
" 35.....	5	26	2	June 3, '13	53.1	"
At Sta 8, sec. 13.....	5	26	2	" 21, '13	18 26.3	"
10°00 N.-						
14°00 W.-NE. cor. sec. 4.....	20	26	2	" 15, '13	20 11.7	B. H. Segre.
At " 10.....	40	26	2	" 7, '13	21.6	R. Neelands.
At " 32.....	22	27	2	July, 5, '13	26.1	B. H. Segre.
At " 10.....	25	27	2	Aug. 4, '13	19 33.4	R. C. Purser.
6°50 E.- " 33.....	25	27	2	July 12, '13	20 26.8	B. H. Segre.
At Sta. 141, sec. 26.....	6	28	2	" 1, '13	19 35.2	C. Rinfret.
At Sta. 5, Traverse lake Johnston.	12	28	2	" 3, '12	31.5	"
At Sta. 14, Traverse lake No. 3..	46	28	2	Dec. 27, '13	24 01.7	R. Neelands.
40°00 S.-NE cor. sec. 10.....	46	28	2	" 29, '13	25 13.9	"
At Sta. 75, sec. 15.....	3	29	2	July 24, '13	19 28.3	C. Rinfret.
At Sta. 2A, sec. 10.....	4	29	2	" 16, '13	21.3	"
At Sta. 2, sec. 23.....	6	29	2	" 7, '13	46.5	"
At Sta. 2A, sec. 23.....	6	29	2	" 8, '13	45.4	"
35°00 W.-NE. cor. sec. 33.....	14	29	2	Nov. 10, '13	44.8	W. J. Deans.
At Sta. 60, sec. 24.....	3	30	2	July 17, '13	05.1	C. Rinfret.
" 24.....	3	30	2	" 19, '13	03.5	"
35°00 S.-NE. cor. sec. 36.....	16	30	2	" 7, '13	59.6	G. A. Bennett.
" 36.....	16	30	2	" 7, '13	58.6	"
At NE. cor. sec. 14.....	18	1	3	Oct. 23, '13	20 47.4	"
At " 23.....	18	1	3	" 25, '13	43.5	"
2°00 N.-NE. cor. sec. 23.....	15	2	3	May 25, '13	32.9	"
" 23.....	15	2	3	" 31, '13	27.2	"
40°00 E.- " 34.....	15	2	3	June 26, '13	41.4	"
" 34.....	15	2	3	" 26, '13	39.5	"
" 34.....	15	2	3	July 5, '13	37.0	"
45°00 S.- " 2.....	16	2	3	May 29, '13	35.5	"
36°00 S.- " 20.....	16	2	3	Sept. 9, '13	21 24.4	C. E. Johnston.
At " 17.....	16	2	3	" 19, '13	24.3	"
40°00 S.- " 19.....	16	2	3	" 24, '13	18.2	"
50°00 N.- " 10.....	57	2	3	Dec. 15, '13	23 33.7	E. W. Hubbell.
40°00 S.- " 23.....	16	3	3	Sept. 11, '13	21 14.1	C. E. Johnston
" 23.....	16	3	3	" 12, '13	12.5	"
At " 34.....	17	3	3	" 1, '13	17.5	"
40°00 S.- " 15.....	18	3	3	" 4, '13	21.1	"
40°00 S.- " 22.....	18	3	3	" 5, '13	25.1	"
" 22.....	18	3	3	" 5, '13	12.5	"
40°00 W.- " 34.....	18	3	3	" 28, '13	20 55.5	"
At " 3.....	19	3	3	" 27, '13	55.1	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
40°00 N.-NE. cor. sec. 3.....	19	3	3	Oct., 6, '13	57.6	C. E. Johnston.
40°00 S.- " 12.....	21	3	3	" 7, '13	20 39.8	"
" 12.....	21	3	3	" 11, '13	34.6	"
" 12.....	21	3	3	" 12, '13	37.9	"
" 12.....	21	3	3	" 13, '13	36.9	"
" 12.....	21	3	3	" 14, '13	36.7	"
" 12.....	21	3	3	" 15, '13	36.8	"
" 12.....	21	3	3	" 19, '13	34.9	"
0°50 N.- " 28.....	30	3	3	May 30, '13	51.4	R. C. Purser.
At " 9.....	30	3	3	June 2, '13	36.2	"
At " 19.....	17	4	3	July 3, '13	21 13.3	C. E. Johnston.
At " 19.....	17	4	3	" 5, '13	15.7	"
At " 19.....	17	4	3	" 6, '13	18.3	"
40°00 S.- " 20.....	17	4	3	" 6, '13	18.9	"
40°00 W.-NE. cor. sec. 9.....	18	4	3	Aug. 20, '13	21 16.1	C. E. Johnston.
40°00 W.- " 2.....	19	4	3	Sept. 30, '13	06.0	"
40°00 W.- " 2.....	19	4	3	Oct. 1, '13	09.9	"
14°75 N.- " 7.....	57	4	3	Dec. 10, '13	32.5	E. W. Hubbell.
15°00 S.- " 36.....	13	5	3	May 28, '13	20 40.0	G. A. Bennett.
At Sta. 53 Chaplin lake trav. sec. 27....	16	5	3	July 17, '13	21 12.3	C. E. Johnston.
At NE. cor. sec. 12.....	16	5	3	" 18, '13	10.6	"
At " 12.....	16	5	3	" 19, '13	14.6	"
At " 12.....	16	5	3	" 20, '13	13.0	"
At " 12.....	16	5	3	" 21, '13	14.4	"
At " 12.....	16	5	3	" 21, '13	13.8	"
40°00 E.-NE. cor. sec. 32.....	17	5	3	June 28, '13	06.8	"
40°00 E.- " 32.....	17	5	3	" 30, '13	09.2	"
40°00 E.- " 32.....	17	5	3	July 1, '13	07.3	"
At Sta. 34 Chaplin lake trav. sec. 1....	17	5	3	" 8, '13	16.4	"
" " " ".....	17	5	3	" 8, '13	17.0	"
40°00 S.-NE. cor. sec. 1.....	17	5	3	" 10, '13	14.4	"
40°00 S.- " 1.....	17	5	3	" 12, '13	30.8	"
40°00 S.- " 1.....	17	5	3	" 15, '13	13.0	"
40°00 S.- " 1.....	17	5	3	" 16, '13	16.2	"
42°00 S.- " 17.....	17	5	3	" 22, '13	13.7	"
42°00 S.- " 17.....	17	5	3	" 23, '13	16.3	"
At Sta. 60 Chaplin lake trav. sec. 3	17	5	3	" 24, '13	17.6	"
10°00 S.-NE. cor. sec. 8.....	25	5	3	Nov. 27, '13	15.8	G. A. Bennett.
At N.E. " 36.....	47	5	3	Oct. 30, '13	22 39.9	R. C. Purser.
75°84 W.- " 19.....	54	5	3	May 29, '13	20 27.9	P. R. A. Belanger.
22°45 W.- " 21.....	54	5	3	June 9, '13	19 45.4	"
31°90 N.- " 21.....	55	5	3	" 3, '13	47.6	"
0°15 S.- " 9.....	56	5	3	" 4, '13	20 22.4	"
At NE. cor. sec. 7.....	57	5	3	Dec. 8, '13	20 42.0	E. W. Hubbell.
41°00 N.-NE. cor. sec. 10.....	20	6	3	June 16, '13	21 33.4	C. E. Johnston.
41°00 N.- " 10.....	20	6	3	" 17, '13	21 35.2	"
41°00 N.- " 10.....	20	6	3	" 18, '13	34.6	"
1°00 N.- " 29.....	25	6	3	Nov. 20, '13	38.5	G. A. Bennett.
4°00 N.- " 14.....	25	6	3	" 22, '13	45.9	"
4°00 N.- " 14.....	25	6	3	Dec. 6, '13	31.0	"
At NE. cor. sec. 10.....	33	6	3	" 31, '13	40.9	R. C. Purser.
15°00 E. $\frac{1}{4}$ cor. N. by sec. 9.....	42	6	3	June 26, '13	20 27.5	"
25°17 S.-N.E. cor. sec. 13.....	15	7	3	" 5, '13	22 13.1	C. E. Johnston.
25°17 S.- " 13.....	15	7	3	" 6, '13	21 57.7	"
At NE. cor. sec. 31.....	17	7	3	" 1, '13	56.8	"
At " 31.....	17	7	3	" 2, '13	22 19.0	"
At " 19.....	27	8	3	Oct. 24, '13	00.4	"
At " 18.....	27	8	3	" 26, '13	21 58.0	"
At SE. " 2.....	23	9	3	Dec. 3, '13	57.8	G. A. Bennett.
27°50 S.-NE. cor. sec. 35.....	24	9	3	" 25, '13	52.1	C. E. Johnston.
27°50 S.- " 35.....	24	9	3	" 29, '13	55.3	"
At Sta. 6, Red Deer lake B. trav. sec. 7	28	9	3	Oct. 31, '13	22 14.0	"
At NE. cor. sec. 8.....	28	9	3	Nov. 1, '13	18.3	"
At " 8.....	28	9	3	" 2, '13	19.2	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At NE. cor. sec. 8.....	28	9	3	" 4, '13	16.5	C..E. Johnston
40.00 W.-NE. cor. sec. 33.....	27	10	3	" 3, '13	21 59.5	"
At NE. " 31.....	27	10	3	" 8, '13	22.5	"
At " 31.....	27	10	3	" 10, '13	56.6	"
8.00 W.-NE. cor. sec. 31	27	10	3	" 12, '13	54.7	"
8.00 W.- " 31... ..	27	10	3	" 16, '13	58.3	"
40.00 N.- " 2 ...	28	10	3	" 2, '13	22 12.0	"
24.35 S.-1°50' E.-NE. cor. sec. 23, Sta. 17, Red Deer lake F trav.	28	11	3	" 14, '13	21 26.3	"
At NE. cor. sec. 30.....	26	12	3	May 26, '13	20 11.6	R. C. Purser.
At Sta. 3 trav. of Lake A, 13.00 E. 11.00 N.-NE. cor. sec. 34.....	31	12	3	Sept. 30, '13	21 46.5	E. P. Bowman.
11.50 S.-N.E. cor. sec. 33.....	54	12	3	Nov. 12, '13	24 45.0	P. R. A. Belanger.
24.00 S.- " 10.....	55	12	3	" 3, '13	28.3	"
At NE cor. sec. 7.....	56	12	3	Nov. 22, '13	25 30.8	P. R. A. Belanger.
40.00 S.- " 3.....	29	13	3	Sept. 29, '13	22 07.5	E. P. Bowman.
4.00 N.- " 5.....	30	13	3	" 27, '13	21 34.8	"
35.00 N.- " 9.....	31	13	3	Oct. 3, '13	22 41.5	"
At NE cor. sec. 16.....	34	13	3	" 31, '13	11.2	"
40.00 S.- " 21.....	35	13	3	Nov. 14, '13	27.6	"
22.50 N.- " 17.....	53	13	3	Aug. 28, '13	23 46.9	P. R. A. Belanger.
At ¼ sec. cor. N by sec. 24 ..	54	13	3	Nov. 17, '13	25 08.1	"
At NE cor. sec. 10.....	56	13	3	" 23, '13	49.3	"
40.00 S.- " 18.....	31	14	3	Oct. 4, '13	23 40.9	E. P. Bowman.
At " 9.....	33	14	3	" 9, '13	17.5	"
At " 32.....	34	14	3	" 18, '13	22 46.0	"
At " 32.....	34	14	3	" 23, '13	26.8	"
10.00 S.- " 21.....	36	14	3	Nov. 19, '13	23 34.2	"
10.00 S.- " 21.....	36	14	3	" 21, '13	25.8	"
50.00 W.- " 32.....	23	15	3	Oct. 20, '13	21 48.0	G. A. Bennett.
20.00 S.- " 15.....	30	15	3	Sept. 26, '13	22 49.6	E. P. Bowman.
3.00 S.- " 10.....	32	15	3	" 25, '13	23 43.3	"
3.00 S.- " 10.....	32	15	3	" 25, '13	44.5	"
3.00 S.- " 10.....	32	15	3	" 25, '13	45.6	"
40.00 S.- " 7.....	34	15	3	Oct. 16, '13	03.8	"
22.00 W.- " 34.....	68	15	3	Apr. 8, '13	25 47.6	A. Saint Cyr.
22.00 W.- " 34.....	68	15	3	" 8, '13	47.7	"
19.00 N.- " 24.....	23	16	3	Oct. 18, '13	21 59.6	G. A. Bennett.
40.00 W.- " 10	31	16	3	Sept. 20, '13	23 34.7	E. P. Bowman.
25.00 W.- " 33.....	32	16	3	" 24, '13	22 40.8	"
11.00 N.- ¼ sec. cor. E by sec. 18	63	16	3	Aug. 17, '13	26 17.3	P. R. A. Belanger.
3.00 W.- NE cor. sec. 31.	68	16	3	Apr. 7, '13	24 56.7	A. Saint Cyr.
3.00 W.- " 31.....	68	16	3	" 7, '13	24 57.2	"
36.00 W.- " 33.....	68	17	3	Jan. 25, '13	24 51.8	"
4.00 W.- " 33.....	68	17	3	" 26, '13	25 01.4	"
4.00 W.- " 33.....	68	17	3	" 26, '13	24 55.3	"
69.00 W.- " 32	68	17	3	" 27, '13	25 13.4	"
35.40 W.- NE cor. sec. 20	18	18	3	May 21, '13	21 46.2	G. A. Bennett.
20.00 S.- " 4.....	28	18	3	Sept. 14, '13	23 13.2	E. P. Bowman.
40.00 S.- " 4.....	28	18	3	" 15, '13	02.8	"
25.00 W.- " 22.....	30	18	3	" 17, '13	12.5	"
20.00 S.- " 27.....	32	18	3	" 2, '13	22 18.6	"
At " 3.....	33	18	3	" 2, '13	32.2	"
18.00 S.- " 15.....	34	18	3	Aug. 31, '13	55.9	"
At Sta. 4 traverse of Lake Eins, 7.61 W.-E. by sec. 33	35	18	3	June 18, '13	22 15.4	"
25.00 S.- NE cor. sec. 14.....	35	18	3	" 26, '13	23 49.4	"
At " 20.....	37	18	3	" 12, '13	24 25.9	"
At Sta. 38, traverse of Aroma Lake, 30.00 S.-N. by sec. 31.....	38	18	3	June 6, '13	23 38.7	"
46.00 W.- NE cor. sec. 35.....	68	18	3	Jan. 31, '13	25 04.9	A. Saint Cyr.
30.00 W.- " 31.....	68	18	3	Feb. 5, '13	26 14.1	"
35.00 N.- " 29.....	28	19	3	Sept. 11, '13	22 29.6	E. P. Bowman.
At " 34.....	29	19	3	" 12, '13	31.2	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE 1. — DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
15°00 S.-NE. cor. sec. 5.....	29	19	3	Sept. 12, '13	30°1	E. P. Bowman.
20°00 N.- " 16.....	32	19	3	" 3, '13	21 41°1	"
2°00 S.- " 9.....	33	19	3	Aug. 27, '13	22 59°3	"
21°00 S.- " 17.....	35	19	3	July 7, '13	53°8	"
At " 23.....	36	19	3	June 17, '13	23 45°6	"
22°00 N.- " 20.....	39	19	3	July 16, '13	21 19°3	R. C. Purser.
17°81 W.- " 22.....	39	19	3	" 18, '13	34°2	"
32°00 S.- " 13.....	39	19	3	May 28, '13	23 19°5	E. P. Bowman.
40°00 S.- " 22.....	40	19	3	Aug. 11, '13	21 59°1	"
15°00 S.- " 18.....	41	19	3	Aug. 10, '13	23 51°4	"
57°00 W.- " 36.....	68	19	3	Feb. 6, '13	27 26°0	A. Saint Cyr.
31°00 N.- 57° E.-NE cor. sec. 34.....	68	19	3	" 8, '13	15°8	"
31°00 N.- " 34.....	68	19	3	" 9, '13	08°0	"
31°00 N.- " 34.....	68	19	3	" 9, '13	18°6	"
31°00 N.- " 34.....	68	19	3	" 9, '13	13°6	"
9°00 N.-NE cor. sec. 17.. . . .	30	20	3	Sept. 8, '13	21 05°1	E. P. Bowman.
At SE cor. sec. 6.....	31	20	3	Sept. 6, '13	21 10°6	"
At NE cor. sec. 17.....	34	20	3	Aug. 22, '13	22 57°0	"
At Sta. 37 traverse of Tramping lake, 18°00 S., 40°00W.-NE cor. sec. 21....	35	20	3	July 12, '13	53°8	"
At Sta. 54, traverse of Tramping lake, 26°00 S., 24°00W.-NE cor. sec. 17....	36	20	3	July 15, '13	33°6	"
40°00 N.-NE cor. sec. 30.....	36	20	3	Aug. 15, '13	38°8	"
At Sta. 157, traverse of Tramping lake, 27°00 E., 17°00S.-NE cor. sec. 30.....	36	20	3	Aug. 16, '13	47°1	"
5°00 E.- " " 19.....	37	20	3	July 20, '13	46°9	"
At Sta. 127, traverse of Tramping lake, 27°00S.-11°00W.-NE cor. sec. 30....	37	20	3	July 23, '13	50°1	"
At Sta. 99, traverse of Tramping lake, 24°00N.-17°00 W.-NE cor. sec. 8.....	38	20	3	July 19, '13	33°3	"
40°00 S.-NE cor. sec 8.....	39	20	3	July 28, '13	23 36°5	"
33°00 S. " " 16.....	40	20	3	July 31, '13	49°3	"
7°00 N. " " 16.....	41	20	3	Aug. 1, '13	24 29°4	"
45°00 W. " " 32.....	68	20	3	April 5, '13	25 32°0	A. Saint Cyr.
At " " 12.....	15	21	3	Nov. 14, '13	22 29°0	G. C. Cowper.
1°00 W. " " 24.....	31	21	3	Sept. 6, '13	03°3	E. P. Bowman.
10°00 S. " " 17.....	33	21	3	Aug. 25, '13	50°7	"
3°00 S. " " 27.....	35	21	3	Aug. 20, '13	35°1	"
9°00 N. " " 16.....	39	21	3	Aug. 13, '13	24 18°1	"
40°00 W. " " 9.....	47	21	3	Nov. 27, '13	25 53°1	"
16°00 S. " " 21.....	62	21	3	July 19, '13	26 00°6	P. R. A. Belanger.
25°00 W. " " 33.....	68	21	3	Feb. 25, '13	25 40°0	A. Saint Cyr.
16°00 W. " " 35.....	68	21	3	Feb. 22, '13	05°7	"
32°00 S. " " 21.....	12	22	3	Dec. 8, '13	21 55°1	G. C. Cowper.
At Sta. 73, traverse Crane lake, sec. 30	13	22	3	Nov. 7, '13	22 18°6	"
At NE cor. sec. 11.....	13	22	3	Dec. 1, '13	11°3	"
40°00 W. " " 33.....	16	22	3	Dec. 15, '13	05°5	"
At Sta. 7, traverse Lake No. 2, sec. 34	16	22	3	Dec. 17, '13	22 15°0	"
20°00 E.-NE. cor. sec. 36.....	47	22	3	Nov. 29, '13	25 36°2	E. P. Bowman.
At Sta 3, traverse of lake in sec. 7, R. 21						
28°33 S., 1°71E.-NE cor. sec. 12.....	47	22	3	Dec. 5, '13	43°4	"
40°00 S.-NE cor. sec. 21.....	47	22	3	Dec. 9, '13	24 47°6	"
20°00 S.-NE cor. sec. 19	61	22	3	July 3, '13	25 20°7	P. R. A. Belanger.
42°00 S.- $\frac{1}{4}$ sec. cor. E. by sec. 15.	62	22	3	July 15, '13	35°1	"
40°00 W.-NE cor. sec. 34.....	68	22	3	Mar. 1, '13	26 56°3	A. Saint Cyr.
40°00 W.-NE cor. sec. 34.....	68	22	3	Mar. 2, '13	26 57°9	"
33°50 W.-NE cor. sec. 31.....	68	22	3	Mar. 3, '13	41°7	"
33°50 W.-NE cor. sec. 31.....	68	22	3	Mar. 4, '13	45°0	"
33°50 W.-NE cor. sec. 31.....	68	22	3	Mar. '13	28°6	"
At Sta. 36, traverse Crane lake, sec. 5.	13	23	3	Nov. 1, '13	22 34°4	G. C. Cowper.
At. Sta. 31, traverse Crane lake, sec. 6.	13	23	3	Nov. 2, '13	39°9	"
At Sta. 4, traverse Lake 1, sec. 36.....	14	23	3	Nov. 26, '13	16°3	"
At NE cor. sec. 17	50	23	3	Aug. 10, '13	23 59°9	R. C. Purser.
At NE cor. sec. 11	61	23	3	July 9, '13	25 39°1	P. R. A. Belanger.

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At NE cor. sec. 24.....	62	23	3	July 21, '13	44.5	P. R. A. Belanger.
2.37 W. - ¼ sec. cor. S. by sec. 4.....	63	23	3	July 30, '13	46.1	"
2.00 W. - NE cor. sec. 36.....	68	23	3	Mar. 4, '13	26 35.5	A. Saint Cyr.
17.00 W. - NE cor. sec. 36.....	68	23	3	Mar. 5, '13	37.9	"
40.00 W. - NE cor. sec. 35.....	68	23	3	Mar. 5, '13	58.2	"
At Sta. 5, traverse of Crane lake, sec. 22	13	24	3	Oct. 30, '13	22 20.0	G. C. Cowper.
At Sta. 27A traverse of Big Stick lake, sec. 20.....	15	24	3	Oct. 18, '13	47.1	"
At NE cor. sec. 12.....	40	24	3	Oct. 20, '13	23 39.3	R. C. Purser.
73.00 W. - NE cor. sec. 36.....	68	24	3	April 3, '13	25 50.4	A. Saint Cyr.
At NE cor. sec. 8.....	15	24	3	Oct. 17, '13	22 38.5	G. C. Cowper.
At NE cor. sec. 22.....	34	25	3	Oct. 15, '13	23 11.1	R. C. Purser.
10.00 E. - " 22.....	34	25	3	" 16, '13	09.0	"
40.00 W. - " 21.....	13	26	3	Sept. 26, '13	22 23.9	G. C. Cowper.
40.00 W. - " 21.....	13	26	3	" 28, '13	21 25.6	"
53.50 W. - " 34.....	68	26	3	Mar. 16, '13	26 10.0	A. Saint Cyr.
53.50 W. - " 34.....	68	26	3	" 16, '13	16.8	"
53.50 W. - " 34.....	68	26	3	" 16, '13	09.3	"
26.00 W. - " 32.....	68	26	3	Mar. 25, '13	27.0	"
53.00 W. - " 34.....	68	26	3	" 26, '13	31.8	"
53.00 W. - " 34.....	68	26	3	" 26, '13	19.7	"
53.00 W. - " 34.....	68	26	3	" 26, '13	24.8	"
53.00 W. - " 34.....	68	26	3	" 27, '13	24.7	"
53.00 W. - " 34.....	68	26	3	" 27, '13	21.4	"
53.00 W. - " 34.....	68	26	3	" 27, '13	20.9	"
21.00 W. - " 31.....	68	26	3	April 5, '13	56.5	"
At ¼ cor. E. by sec 22.....	51	27	3	Oct. 10, '13	23 54.0	R. C. Purser.
At ¼ cor. S. by sec. 2.....	51	27	3	July 3, '13	41.2	"
50.27 E. - NE cor. sec. 35.....	6	30	3	June 23, '13	22 34.1	A. M. Narraway.
50.46 S. - " 29.....	6	30	3	" 24, '13	25.5	"
48.00 S. - " 33.....	6	30	3	July 4, '13	04.2	"
At " 11.....	6	30	3	" 9, '13	18.8	"
At " 22.....	7	30	3	June 26, '13	21 17.3	"
57.69 N. - " 11.....	7	30	3	July, 2, '13	53.2	"
79.80 N. - " 15.....	7	30	3	" 7, '13	54.0	"
At " 22.....	29	30	3	Sept. 9, '13	22 31.9	E. P. Bowman.
At Sta. 7, Traverse lake, No. 2, sec. 34.....	16	1	4	" 11, '13	23 09.5	G. C. Cowper.
2.90 S. - NE cor. sec. 36.....	68	1	4	Mar. 25, '13	27 20.6	A. Saint Cyr.
56.92 W. - " 33.....	84	1	4	" 18, '13	29 54.0	G. H. Blanchet.
27.07 W. - " 31.....	96	1	4	Sept. 15, '13	30 07.3	J. B. McFarlane.
At " 5.....	1	2	4	June 24, '13	22 18.0	G. C. Cowper.
76.24 W. - " 32.....	84	2	4	Mar. 25, '13	29 20.7	G. H. Blanchet.
40.00 W. - " 35.....	96	2	4	Sept. 16, '13	36.1	J. B. McFarlane.
24.00 E. - " 35.....	5	3	4	" 24, '13	21 30.5	A. M. Narraway.
19.00 N. - " 32.....	5	3	4	Oct. 1, '13	29.3	"
34.00 E. - " 32.....	5	3	4	" 2, '13	36.1	"
8.00 N. - " 20.....	6	3	4	Sept. 27, '13	33.9	"
40.00 N. - " 22.....	6	3	4	Oct. 3, '13	20.9	"
At ¼ cor. E. by sec. 26.....	8	3	4	June 15, '13	22 35.0	G. C. Cowper.
At NE cor. sec. 1.....	14	3	4	Sept. 14, '13	23 08.4	"
25.46 W. - " 33.....	84	3	4	Mar. 30, '13	27 25.9	G. H. Blanchet.
22.12 N. - " 34.....	5	4	4	Sept. 15, '13	21 43.0	A. M. Narraway.
15.00 E. - " 21.....	6	4	4	" 8, '13	58.0	"
40.50 E. - " 20.....	6	4	4	Sept. 10, '13	22 10.5	"
15.00 E. - " 7.....	6	4	4	" 12, '13	09.0	"
At ¼ cor. N. by sec. 7.....	9	4	4	June 3, '13	45.0	G. C. Cowper.
1.00 E. - NE cor. sec 33.....	19	4	4	Aug. 26, '13	23 01.3	"
76.24 W. - " 36.....	84	4	4	April 3, '13	29 54.5	G. H. Blanchet.
72.00 W. - " 33.....	84	4	4	" 9, '13	27.6	"
30.00 W. - " 32.....	5	5	4	July 18, '13	22 26.1	A. M. Narraway.
50.00 S. - " 26.....	6	5	4	" 14, '13	22.8	"
40.00 S. - " 2.....	6	5	4	" 15, '13	26.6	"
20.00 W. - " 22.....	6	5	4	" 16, '13	21.2	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
10°00 N.-NE. cor. sec. 22	6	5	4	July 21, '13	33°0	A. M. Narraway.
76°60 N.-" 27	6	5	4	" 21, '13	28°3	"
At " 30	8	5	4	May 29, '13	39°0	G. C. Cowper.
10°00 S.-" 30	8	5	4	" 30, '13	47°0	"
At " 14	8	5	4	June 1, '13	42°0	"
8°00 W.-NE cor. sec. 23	17	5	4	Sept. 11, '13	23 04°9	G. A. Bennett.
40°00 S.-" 14	17	5	4	" 13, '13	22 56°4	"
40°67 W.-" 35	96	5	4	Oct. 18, '13	29 18°1	J. B. McFarlane.
21°17 W.-" 36	84	6	4	Apr. 19, '13	30 23°4	G. H. Blanchet.
64°39 W.-" 33	92	6	4	June 7, '13	28 59°9	J. B. McFarlane.
2°82 W.-" 31	92	6	4	" 10, '13	17°7	"
70°00 W.-" 31	92	6	4	" 11, '13	10°0	"
40°00 N.-" 5	5	7	4	July 7, '13	22 37°2	G. C. Cowper.
28°73 W.-" 32	84	7	4	May 1, '13	29 55°2	G. H. Blanchet.
6°79 W.-" 34	92	7	4	June 13, '13	27°5	J. B. McFarlane.
67°41 W.-" 31	92	7	4	" 19, '13	30 24°8	"
At " 36	96	7	4	Nov. 6, '13	29 04°9	"
20°00 W.-" 31	96	7	4	" 13, '13	30 43°7	"
5°00 N.- $\frac{1}{4}$ cor. E. by sec. 36	3	8	4	July 3, '13	22 19°7	G. C. Cowper.
5°00 N.-" 36	3	8	4	" 5, '13	18°7	"
40°00 N.-NE. cor. sec. 7	5	8	4	" 17, '13	44°1	"
At $\frac{1}{4}$ cor. E. by sec. 31	9	8	4	May 22, '13	51°2	"
At " 31	9	8	4	" 24, '13	52°4	"
At NE. cor. sec. 13	21	8	4	Aug. 18, '13	23 43°3	"
" 13	21	8	4	" 19, '13	46°0	"
72°80 W.-" 34	84	8	4	May 8, '13	29 47°5	G. H. Blanchet.
10°00 W.-" 35	92	8	4	June 21, '13	31 10°2	J. B. McFarlane.
21°64 W.-" 32	92	8	4	" 30, '13	30 00°3	"
At " 31	92	8	4	July 2, '13	04°8	"
" 19	2	9	4	Aug. 21, '13	22 27°2	A. M. Narraway.
20°00 N.-" 21	2	9	4	" 25, '13	09°0	"
15°00 N.-" 15	2	9	4	" 26, '13	22 00°0	"
47°00 N.-" 27	2	9	4	" 27, '13	01°2	"
15°00 N.-" 11	2	9	4	Sept. 1, '13	21 59°3	"
9°61 E.-" 31	18	9	4	Aug. 1, '13	22 55°4	G. A. Bennett.
50°00 W.-SE " 6	19	9	4	" 1, '13	52°3	"
21°00 N.-" 4	19	9	4	Oct. 23, '13	23 11°8	A. M. Narraway.
At Sta. 8, Sturgis lake, sec. 18	50	9	4	" 25, '13	25 51°1	G. W. Coltham.
At Sta. 13, Lake No. 1, sec. 26	52	9	4	Aug. 18, '13	26 32°1	"
55°08 W.-NE. cor. sec. 31	84	9	4	May 16, '13	29 43°5	G. H. Blanchet.
34°00 W.-" 35	84	9	4	" 13, '13	31 09°2	"
22°41 W.-" 32	92	9	4	July 9, '13	29 35°7	J. B. McFarlane.
60°00 W.-" 35	96	9	4	Nov. 26, '13	30 32°2	"
40°88 W.-" 31	96	9	4	Dec. 2, '13	09°4	"
At " 33	1	10	4	Aug. 16, '13	22 36°0	A. M. Narraway.
49°00 S.-" 8	2	10	4	" 11, '13	34°8	"
10°00 E.-" 23	2	10	4	" 13, '13	36°7	"
At " 7	2	10	4	" 15, '13	26°2	"
40°00 N.-" 5	18	10	4	Oct. 14, '13	23 34°9	"
40°00 E.-" 35	18	10	4	July 29, '13	22°8	G. A. Bennett.
At " 33	18	10	4	" 31, '13	19°8	"
7°00 W.-SE. " 2	19	10	4	Aug. 4, '13	22 59°3	"
47°00 W.-" 2	19	10	4	" 4, '13	23 11°3	"
49°00 W.-" 2	19	10	4	" 4, '13	05°9	"
49°00 W.-" 2	19	10	4	" 4, '13	06°7	"
49°00 W.-" 2	19	10	4	" 4, '13	08°5	"
60°40 W.-NE. " 31	20	10	4	May 16, '13	05°9	A. M. Narraway.
41°50 N.-" 25	21	10	4	" 14, '13	10°4	"
28°00 E.-" 32	21	10	4	" 21, '13	19°8	"
1°00 N.-" 7	21	10	4	" 26, '13	24°2	"
40°15 N.-SE. " 20	21	10	4	" 28, '13	14°0	"
40°00 S.-NE. " 9	49	10	4	Oct. 31, '13	25 39°1	G. W. Coltham.
12°00 E.-" 30	50	10	4	" 23, '13	26 07°5	"
At Sta. 5, Lake No. 2	51	10	4	Aug. 25, '13	13°1	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
65°42' W.-NE. cor. sec. 35.....	92	10	4	July 18, '13	29 25.4	J. B. McFarlane.
20°00' W.-" 31.....	96	10	4	Dec. 15, '13	28 30.4	"
At " 36.....	18	11	4	July 31, '13	23 44.3	G. A. Bennett.
At SE. " 1.....	19	11	4	" 13, '13	45.7	"
23°00' W.-NE cor. sec. 34.....	20	11	4	Nov. 8, '13	23 23.4	A. M. Narraway
62°36' N.-" 13.....	21	11	4	May 20, '13	22 15.5	"
38°00' N.-" 4.....	21	11	4	Nov. 3, '13	23 27.1	"
7°00' N.-" 4.....	21	11	4	" 3, '13	29.8	"
At " 11.....	21	11	4	" 7, '13	09.4	"
At Sta. 6, Lake Alice, sec. 9.....	49	11	4	" 1, '13	26 18.6	G. W. Coltham
50°00' S.-N.E. cor. sec. 5.....	50	11	4	Sept. 30, '13	14.8	"
At Sta. 225, Birch lake, sec. 34.....	50	11	4	Oct 13, '13	25 59.2	"
At Sta. 8, Lake 3, sec. 19.....	51	11	4	Aug. 27, '13	26 15.8	"
At Sta. 4, Lake 6, sec. 19.....	52	11	4	July 22, '13	22.5	"
10°00' N.-NE cor. sec. 11.....	52	11	4	Aug. 1, '13	20.8	"
15°00' W.-" 34.....	84	11	4	May 26, '13	30 00.8	G. H. Blanchet
15°00' " 34.....	84	11	4	" 26, '13	29 41.5	"
38°60' W.-" 34.....	92	11	4	Aug. 1, '13	39.7	J. B. McFarlane
60°00' W.-" 32.....	96	11	4	Dec. 29, '13	46.0	"
4°00' S.-" 10.....	21	12	4	Nov. 14, '13	23 18.4	A. M. Narraway
20°00' E.-" 33.....	21	12	4	" 21, '13	18.2	"
At Sta. 18, Lake Thomas.....	47	12	4	" 12, '13	26 02.7	G. W. Coltham
17°00' N.-NE cor. sec. 8.....	48	12	4	" 17, '13	10.5	"
At Sta. A, Lake No. 2.....	48	12	4	" 17, '13	14.7	"
50°00' N.-NE cor. sec. 36.....	49	12	4	Sept. 29, '13	11.8	"
At Sta. 2, Lake No. 1.....	49	12	4	Nov. 7, '13	15.9	"
64°00' S.-NE cor. sec. 17.....	50	12	4	Sept. 23, '13	07.3	"
10°00' S.-" 17.....	50	12	4	" 24, '13	10.8	"
At Sta. 77, Birch lake.....	50	12	4	" 27, '13	07.5	"
At Station 3, Lake V.....	51	12	4	" 15, '13	16.8	"
5°00' N.-NE cor. sec. 18.....	52	12	4	June 11, '13	21.3	"
At Sta. 2, Lake A, sec. 11.....	52	12	4	July 5, '13	24.4	"
At Sta. 9, Lake S, Sec. 11.....	52	12	4	" 17, '13	20.5	"
18°20' W.-NE cor. sec. 31.....	84	12	4	June 5, '13	29 43.1	G. H. Blanchet
At Sta. 4, Traverse. Indian lake, sec. 9.....	55	13	4	July 22, '13	22 38.2	G. C. Cowper
At Sta. 3, Lake A, Sec. 13.....	51	13	4	Sept. 18, '13	26 13.3	G. W. Coltham
14°00' S.-NE cor. sec. 16.....	52	13	4	May 31, '13	06.1	"
45°20' W., 60°00' N.-NE cor. sec. 9.....	52	13	4	June 5, '13	03.0	"
At SE cor. sec. 2.....	3	14	4	July 30, '13	22 48.0	A. M. Narraway
9°00' W.-SE cor. sec. 5.....	3	15	4	" 29, '13	30.0	"
5°00' E.-" 4.....	3	15	4	Aug. 1, '13	23 09.2	"
3°84' N.-" 3.....	3	15	4	" 5, '13	22 03.5	"
At NE " 9.....	32	15	4	Oct. 15, '13	24 40.7	J. B. Saint Cyr
0°50' N.-" 10.....	9	16	4	" 15, '13	23 15.0	G. A. Bennett
" " 10.....	9	16	4	" 15, '13	12.8	"
At ¼ cor. E. by sec. 9.....	34	16	4	" 22, '13	24 44.6	J. B. Saint Cyr
" " 16.....	34	17	4	" 14, '13	27.3	"
At NE cor. sec. 34.....	35	17	4	" 11, '13	28.6	"
At ¼ cor. E. by sec. 23.....	37	17	4	" 3, '13	52.8	"
At NE cor. sec. 22.....	38	17	4	Nov. 8, '13	57.2	"
60°00' S.-" 25.....	38	17	4	" 10, '13	25 01.9	"
At ¼ cor. E. by sec. 1.....	34	18	4	Sept. 24, '13	24 40.4	"
At NE cor. sec. 9.....	35	18	4	" 19, '13	30.4	"
At ¼ cor. N. by sec. 35.....	35	18	4	" 23, '13	47.6	"
At NE cor. sec. 14.....	36	18	4	" 29, '13	55.0	"
At " 8.....	37	18	4	Nov. 5, '13	55.6	"
At ¼ cor. E. by sec. 32.....	37	18	4	" 6, '13	25 18.3	"
20°00' S.-NE cor. sec. 19.....	37	18	4	" 7, '13	07.0	"
At ¼ cor. E. by sec. 17.....	36	19	4	Oct. 25, '13	24 52.5	"
At " " 30.....	36	19	4	" 30, '13	25 19.1	"
At NE cor. sec. 27.....	36	19	4	" 31, '13	15.6	"
At " 4.....	37	19	4	Nov. 1, '13	03.9	"
At " 5.....	37	19	4	" 3, '13	24 42.5	"
" 5.....	37	19	4	" 4, '13	25 09.1	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At NE. cor. sec. 11.	38	19	4	Nov. 13, '13	08.5	J. B. Saint Cyr.
41°00 S.- " 10	38	19	4	" 13, '13	10.5	"
60°00 N.- " 22.....	73	19	4	" 2, '13	29 06.2	C. F. Miles
60°00 " 22	73	19	4	" 2, '13	28 57.5	"
10°00 N.-NE cor. sec. 15....	73	19	4	Oct. 19, '13	28 54.8	C. F. Miles.
20°00 S.- " " 28.....	31	20	4	Sept 13, '13	25 01.6	J. B. Saint Cyr.
At ¼ sec. cor. W. by sec. 7.....	37	20	4	Nov. 18, '13	24 40.4	"
At NE cor. sec. 8.....	37	20	4	" 18, '13	25 05.3	"
At ¼ sec. cor. E. by sec. 22.....	38	20	4	" 15, '13	24 55.0	"
At NE cor. sec. 21....	38	20	4	" 22, '13	53.5	"
10°00 W.-NE cor. sec. 34.....	38	20	4	" 26, '13	44.7	"
78°10 " " 33.....	84	20	4	Dec. 23, '13	30 08.3	G. H. Blanchet.
6°00 E.-¼ sec. cor. N. by sec. 22....	34	21	4	Oct. 25, '13	24 21.6	R. C. Purser.
20°00 S.-17°00 W. ¼ sec. cor. N. by sec. 22	34	21	4	" 25, '13	38.5	"
At ¼ sec. cor. W. by sec. 26.....	38	21	4	Nov. 25, '13	25 03.7	J. B. Saint Cyr.
At NE cor. sec. 34	38	21	4	" 28, '13	06.5	"
At " " 27.....	35	22	4	Aug. 28, '13	24 58.5	"
At ¼ sec. cor. E. by sec. 8 ..	35	22	4	" 30, '13	48.2	"
At NE cor. sec. 33.....	36	22	4	Sept. 6, '13	25 24.4	"
At ¼ sec. cor. E. by sec. 28.....	36	22	4	" 12, '13	33.1	"
At " " 19.....	36	22	4	" 8, '13	51.7	"
At NE cor. sec. 13.....	39	22	4	Dec. 19, '13	31.8	"
At " " 31.....	39	22	4	" 20, '13	23.5	"
At " " 19.....	35	23	4	Aug. 23, '13	18.1	"
At " " 10.....	36	23	4	Sept. 5, '13	13.1	"
At " " 21.....	37	23	4	Dec. 2, '13	23.7	"
5°00 N.-NE. cor. sec. 2.....	37	23	4	" 5, '13	10.9	"
At NE cor. sec. 16....	39	23	4	" 2, '13	31.4	"
40°00 E.-NE cor. sec. 20	35	24	4	Aug. 11, '13	10.6	"
At NE cor. sec. 15.....	35	24	4	" 13, '13	14.6	"
At " " 17	35	24	4	" 16, '13	18.9	"
At ¼ sec. cor. E. by sec. 23.....	37	24	4	Dec. 8, '13	19.0	"
At NE cor. sec. 9	37	24	4	" 9, '13	23.7	"
12°09 E.-NE cor. sec. 35.....	1	25	4	Oct. 8, '13	23 36.4	G. A. Bennett.
At Sta. 6, traverse of St. Mary's river,						
27°00 E., 42°00 N. SE cor. sec. 2	2	25	4	" 11, '13	23 35.4	"
At ¼ sec. cor. E. by sec. 9.....	35	25	4	Aug. 7, '13	25 09.2	J. B. Saint Cyr.
At SE cor. sec. 9	37	25	4	Dec. 13, '13	32.3	"
At NE " 21 ..	37	25	4	" 11, '13	24.0	"
At " " 32.....	41	25	4	June 24, '13	26 05.6	"
At SW " 3	35	26	4	Aug. 3, '13	25 12.9	"
At NE " 11.....	36	26	4	July 31, '13	50.4	"
39°00 S.-NE cor. sec. 31.....	40	26	4	June 29, '13	59.6	"
40°00 " " 28.	34	27	4	Aug. 4, '13	30.8	"
20°00 " " 15.....	36	27	4	July 29, '13	08.6	"
At NE cor. sec. 29.....	39	27	4	" 5, '13	58.2	"
At " " 32.....	39	27	4	" 6, '13	57.9	"
40°00 S.-NE cor. sec. 34	39	27	4	" 9, '13	26 14.3	"
39°00 E. " " 23.....	39	27	4	" 11, '13	25 48.9	"
8°00 N.-¼ sec. cor. N. by sec. 23.....	39	27	4	" 14, '13	52.4	"
24°00 " " E. " 6.....	39	27	4	" 18, '13	39.8	"
43°00 W.-NE cor. sec. 29.....	1	28	4	Aug. 11, '13	23 58.0	G. A. Bennett.
10°00 N.- " " 33.....	36	28	4	July 23, '13	25 27.5	J. B. Saint Cyr.
At NE cor. sec. 22..	36	28	4	" 24, '13	27.4	"
At NE cor. sec. 8.	36	28	4	" 28, '13	26 35.3	"
40°00 W.-E. by sec. 22 on lake shore...	40	28	4	May 23, '13	27 20.4	"
55°20 S.-NE cor. sec. 28.....	41	28	4	" 21, '13	24 55.8	"
17°00 N.- " " 22.....	42	28	4	June 22, '13	25 26.5	"
13°00 W.- " " 26	1	29	4	Aug. 13, '13	24 06.3	G. A. Bennett.
40°00 N.- " " 1.....	2	29	4	" 10, '13	23 51.4	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
Base Line between lots 39 and 40.....	a	a	4	Nov. 2, '11	26 11.1	H. S. Day.
" " ".....	a	a	4	" 20, '11	25 40.1	"
" " ".....	a	a	4	" 20, '11	40.5	"
38.00 E. Base Line where it crosses N. by lot 8.....	b	b	4	June 19, '11	28 59.6	"
At intersection of Base Line with N. by lot 8.....	b	b	4	" 24, '11	01.5	"
At intersection of Base Line with N. by lot 14.....	b	b	4	July 5, '11	29 03.6	"
At Station 1, Trav. N. of N. by lot 7, 60.00 W. of Base Line.....	c	c	4	" 25, '11	31 18.2	"
" " ".....	c	c	4	Aug. 8, '11	19 8	"
Base Line between lots 18 and 19.....	c	c	4	" 12, '11	25.3	"
" " 35 and 36.....	d	d	4	" 28, '11	29 52.5	"
20.00 W. Base Line on N. by. of set- tlement.....	d	d	4	Sept. 13, '11	45.9	"
At NE cor. lot 5.....	e	e	4	" 29, '11	30 53.0	"
At NW cor. lot 5.....	e	e	4	Oct. 4, '11	49.7	"
At T.H. 17, NW trav. Slave river.....	f	f	4	Aug. 22, '12	33 17.4	E. A. Neville.
At Alberta-NWT by Monument, W. side Slave river.....	f	f	4	" 27, '12	21.7	"
4.00 NW.-SW cor. lot 1.....	f	f	4	" 31, '12	13.1	"
At I.P. 24, 25, 26.....	f	f	4	Sept. 5, '12	09.0	"
At SW cor. lot 49.....	f	f	4	" 6, '12	02.7	"
25.00 N.-NW cor. lot 66.....	f	f	4	" 9, '12	32 26.7	"
40.00 N.-SW " 60.....	f	f	4	" 10, '12	50.6	"
At T.H. Slave river.....	f	f	4	" 11, '12	33 20.9	"
At I.P. 62-63 on Base Line.....	f	f	4	" 7, '12	32 39.1	"
At NE cor. lot 25.....	g	g	4	July 9, '12	33 36.3	"
At NW " 22.....	g	g	4	" 10, '12	12.1	"
At SW " 62.....	g	g	4	" 24, '12	19.3	"
At NW " 39.....	g	g	4	Aug. 4, '12	09.7	"
12.00 E.-NE cor. sec. 35.....	40	1	5	May 24, '13	26 14.6	J. B. Saint Cyr.
10.00 N.- " 21.....	41	1	5	" 31, '13	58.1	"
33.28 N.- " 21.....	42	1	5	June 6, '13	25 31.5	"
25.00 S.- " 27.....	42	1	5	" 11, '13	26 41.0	"
At ¼ cor. E. by. sec. 32.....	10	3	5	Aug. 7, '13	22 53.3	M. P. Bridgland.
At NE cor. sec. 13.....	10	3	5	" 22, '13	24 07.6	"
At " 13.....	10	3	5	" 22, '13	06.2	"
At " 12.....	10	3	5	" 22, '13	01.2	"
At " 6.....	11	3	5	July 4, '13	26 06.5	"
At ¼ cor. E. by. sec. 7.....	11	3	5	" 4, '13	24 14.1	"
At SE cor. sec. 6.....	11	3	5	" 5, '13	22 57.4	"
At ¼ cor. E. by. sec. 6.....	11	3	5	" 5, '13	23 46.3	"
At NE cor. sec. 7.....	11	3	5	" 5, '13	07.2	"
At " 19.....	11	3	5	" 5, '13	45.9	"
At ¼ cor. E. by. sec. 19.....	11	3	5	" 5, '13	11.3	"
At " " 18.....	11	3	5	" 5, '13	21 48.1	"
10.00 S.-NE cor. sec. 7.....	17	3	5	June 7, '13	25 14.8	S. L. Evans.
60.00 N.- " 8.....	17	3	5	" 8, '13	13.5	"
0.50 N.- " 9.....	17	3	5	" 8, '13	08.2	"
At NE cor. sec. 24.....	8	4	5	Aug. 27, '13	24 02.4	M. P. Bridgland.
At ¼ cor. N. by. sec. 34.....	9	4	5	" 10, '13	03.8	"
At " " 34.....	9	4	5	" 14, '13	06.5	"
At " " 34.....	9	4	5	" 14, '13	09.2	"
At NE cor. sec 33.....	9	4	5	" 10, '13	23 58.6	"
At " 33.....	9	4	5	" 10, '13	59.5	"
At " 34.....	9	4	5	" 14, '13	24 03.1	"
At " 23.....	9	4	5	" 23, '13	07.4	"
At " 23.....	9	4	5	" 24, '13	02.2	"

a Chipewyan Settlement. b Pelican Settlement. c Grand Rapids Settlement. d McMurray Settlement.
e McKay Settlement. f Fort Smith Settlement. g Smith Landing Settlement.

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
At NE. cor. sec. 23.....	9	4	5	Aug. 24, '13	04.2	M. P. Bridgland.
At " " 35.....	9	4	5	" 24, '13	03 56.2	"
At $\frac{1}{4}$ cor. N. by. sec. 36.....	9	4	5	" 23, '13	17.1	"
41.00 S.-NE cor. sec. 25.....	10	4	5	Aug. 7, '13	23 03.4	"
At " " 24.....	10	4	5	" 7, '13	03.9	"
0.50 S.- " 32.....	16	4	5	July 17, '13	25 00.7	S. L. Evans.
8.00 S.- " 33.....	16	4	5	" 17, '13	01.5	"
20.00 N.- " 10.....	17	4	5	" 5, '13	09.7	"
0.50 N.- " 9.....	17	4	5	" 8, '13	64.2	"
42.00 N.- " 27.....	17	4	5	" 16, '13	08.5	"
0.50 N.- " 28.....	17	4	5	" 16, '13	06.5	"
0.50 S.- " 31.....	17	4	5	" 17, '13	04.3	"
0.50 N.- " 9.....	18	4	5	" 27, '13	02.4	"
60.00 N.- " 8.....	18	4	5	Aug. 3, '13	02.1	"
8.00 W.- " 35.....	18	4	5	" 22, '13	23 33.8	"
38.00 W.- " 35.....	18	4	5	" 23, '13	24 59.8	"
0.50 W.- " 22.....	18	4	5	" 26, '13	25 06.5	"
0.50 S.- " 35.....	19	4	5	Sept. 1, '13	18.5	"
4.50 S.- " 27.....	19	4	5	" 16, '13	01.3	"
32.00 W.- " 30.....	19	4	5	" 26, '13	09.6	G. A. Bennett.
At NE cor. L.S. III, sec. 31.....	19	4	5	" 27, '13	08.5	"
17.00 S.-NE cor. sec. 30.....	20	4	5	" 26, '13	04.9	S. L. Evans.
At " " 2.....	12	5	5	July 14, '13	23 46.5	M. P. Bridgland.
At $\frac{1}{4}$ cor. sec. E. by sec 13.....	12	5	5	" 15, '13	45.0	"
71.00 S. NE cor. sec. 18.....	23	5	5	Oct. 12, '13	24 56.2	S. L. Evans.
1.00 N.- " 5.....	23	5	5	" 20, '13	25 00.0	"
31.50 E.- " 31.....	104	10	5	Sept. 22, '13	30 50.1	J. R. Akins.
41.13 E.- " 31.....	104	11	5	" 16, '13	13.3	"
45.50 E.- " 32.....	104	11	5	" 17, '13	16.8	"
5.00 W.- " 34.....	104	11	5	" 18, '13	00.6	"
76.38 E.- " 36.....	104	12	5	" 15, '13	29 56.1	"
18.70 E.- " 34.....	104	12	5	" 12, '13	31 21.7	"
3.00 E.- " 31.....	104	13	5	Aug. 30, '13	33 32.0	"
48.87 E.- " 36.....	104	13	5	Sept. 8, '13	35.5	"
72.79 E.- " 36.....	104	14	5	Aug. 23, '13	34 27.1	"
22.00 E.- " 32.....	104	14	5	" 26, '13	33 34.0	"
6.00 E.- " 35.....	104	14	5	" 28, '13	16.2	"
27.36 E.- " 32.....	104	16	5	" 12, '13	25 10.9	"
39.00 E.- " 33.....	104	16	5	" 13, '13	34 53.0	"
2.00 E.- " 35.....	104	16	5	" 15, '13	53.4	"
67.00 E.- " 35.....	104	16	5	" 16, '13	35.1	"
23.25 E.- " 36.....	104	16	5	" 18, '13	40.6	"
20.00 S.- " 20.....	23	17	5	" 13, '13	25 56.0	N. C. Stewart.
27.00 N.-SE cor. sec. 28.....	23	17	5	" 16, '13	55.5	"
37.00 N.- " 34.....	23	17	5	" 20, '13	26 07.2	"
43.70 E.-SW " 2.....	24	17	5	" 22, '13	04.4	"
At SE " 2.....	24	17	5	" 23, '13	25 56.7	"
65.00 N.- " 2.....	24	17	5	" 25, '13	26 07.9	"
5.00 N.- " 12.....	24	17	5	" 27, '13	25 58.3	"
70.00 N.- " 12.....	24	17	5	" 28, '13	57.1	"
16.50 E.-NE " 31.....	104	17	5	" 4, '13	33 48.8	J. R. Akins.
50.00 E.- " 11.....	23	18	5	July 21, '13	26 15.8	N. C. Stewart.
20.00 N.-SE " 13.....	23	18	5	" 23, '13	25 57.3	"
46.00 N.- " 13.....	23	18	5	" 24, '13	56.9	"
15.00 E.-NE " 13.....	23	18	5	" 31, '13	56.7	"
60.00 E.- " 13.....	23	18	5	Aug. 1, '13	50.1	"
38.10 N.- " 25.....	90	18	5	Apr. 23, '13	31 41.7	J. A. Fletcher.
7.25 E.- " 31.....	92	18	5	May 1, '13	13.6	J. R. Akins.
10.00 W.- " 35.....	92	18	5	" 2, '13	12.6	"
42.10 E.- " 35.....	92	18	5	" 5, '13	30.2	"
68.33 E.- " 33.....	92	18	5	" 13, '13	30 40.0	"
80.25 W.- " 36.....	96	18	5	June 5, '13	31 15.2	"
75.50 W.- " 35.....	96	18	5	" 6, '13	32 27.0	"
32.00 N.- " 12.....	96	18	5	May 31, '13	31 24.7	J. A. Fletcher.

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
26°00 N.-NE. cor. sec. 36.....	96	18	5	June 4, '13	30 58.1	J. A. Fletcher.
54°47 N.- " 1.....	97	18	5	" 5, '13	31 38.2	"
2°00 N.- " 13.....	99	18	5	" 19, '13	32 37.6	"
31°36 N.- " 36.....	99	18	5	" 24, '13	25.0	"
4°50 S.-NE cor. sec. 25...	100	18	5	June 30, '13	32 40.6	"
80°00 W.- " 36.....	100	18	5	July 4, '13	54.5	J. R. Akins.
10°83 W.- " 34.....	100	18	5	" 5, '13	57.0	"
43°00 N.- " 24.....	101	18	5	" 12, '13	33 02.3	J. A. Fletcher.
8°80 N.- " 25.....	103	18	5	" 18, '13	34 41.6	"
8°00 S.- " 1.....	104	18	5	" 18, '13	52.6	"
46°20 W.- " 36.....	104	18	5	" 25, '13	33 40.5	J. R. Akins.
21°75 W.- " 34.....	104	18	5	" 27, '13	22.9	"
61°00 S.- " 25.....	107	18	5	Aug. 28, '13	34 50.1	J. A. Fletcher.
50°00 S.- " 36.....	108	18	5	" 13, '13	33 44.9	"
41°00 S.- " 25.....	108	18	5	" 15, '13	55.7	"
42°14 W.- " 34.....	108	18	5	" 25, '13	32 59.8	"
15°00 E.-NW " 31.....	46	19	5	Dec. 18, '12	28 12.6	A. L. McNaughton.
2°12 E.-NE " 31.....	92	19	5	Apr. 28, '13	32 11.2	J. R. Akins.
4°00 W.- " 36.....	96	19	5	June 10, '13	33.9	"
14°32 W.- " 32.....	96	19	5	" 13, '13	24.3	"
21°25 W.- " 33.....	100	19	5	July 8, '13	33 13.6	"
79°20 W.- " 32.....	100	19	5	" 9, '13	32 49.9	"
20°82 W.- " 36.....	100	19	5	" 10, '13	48.3	"
63°42 W.- " 35.....	100	19	5	" 11, '13	30.6	"
12°99 W.- " 35.....	104	19	5	Sept. 8, '13	33 54.7	J. A. Fletcher.
73°90 E.- " 32.....	92	20	5	Apr. 24, '13	12.8	J. R. Akins.
62°83 W.- " 35.....	96	20	5	June 17, '13	32 57.7	"
38°88 W.- " 36.....	96	20	5	" 18, '13	39.1	"
50°13 W.- " 33.....	96	20	5	" 19, '13	51.2	"
3°91 W.- " 34.....	100	20	5	July 17, '13	18.3	"
59°50 W.- " 32.....	100	20	5	" 19, '13	49.5	"
46°82 W.- " 32.....	104	20	5	Sept. 17, '13	33 55.8	J. A. Fletcher.
53°83 N.- " 10.....	84	21	5	Dec. 18, '13	31 28.6	L. E. Fontaine.
60°00 E.- " 31.....	92	21	5	Apr. 17, '13	32 30.6	J. R. Akins.
45°65 E.- " 36.....	92	21	5	" 21, '13	33 27.1	"
50°00 W.- " 35.....	96	21	5	June 22, '13	32 18.5	"
57°35 W.- " 31.....	104	21	5	Sept. 22, '13	34 04.5	J. A. Fletcher.
10°00 E.-NE " 19.....	47	22	5	" 5, '12	27 58.3	A. L. McNaughton.
60°00 N.- " 20.....	47	22	5	" 7, '12	53.6	"
15°00 N.- " 19.....	47	22	5	" 9, '12	53.7	"
15°00 N.- " 29.....	47	22	5	" 7, '12	56.1	"
50°00 S.- " 19.....	47	22	5	" 20, '12	58.0	"
60°00 S.- " 18.....	47	22	5	" 27, '12	28 00.5	"
5°00 W.- " 33.....	47	22	5	Nov. 8, '12	27 55.6	"
32°00 S.- " 15.....	48	22	5	July 11, '12	28 01.4	"
10°00 S.- " 11.....	48	22	5	" 17, '12	01.0	"
0°93 S.- " 13.....	83	22	5	Dec. 11, '13	31 32.3	L. E. Fontaine.
3°00 S.- " 13.....	89	22	5	Mar. 27, '13	57.8	J. R. Akins.
35°77 N.- " 36.....	89	22	5	" 31, '13	57.5	"
30°00 S.- " 12.....	90	22	5	Apr. 2, '13	45.6	"
24°40 N.- " 25.....	90	22	5	" 5, '13	27.6	"
73°72 W.- " 36.....	90	22	5	" 7, '13	40.1	"
70°80 N.-SE " 1.....	91	22	5	" 8, '13	55.3	"
" " 1.....	91	22	5	" 9, '13	41.6	"
56°80 N.-NE " 25.....	91	22	5	" 14, '13	44.9	"
23°51 N.- " 1.....	92	22	5	" 15, '13	50.6	"
5°00 E.- " 24.....	47	23	5	Sept. 5, '12	28 04.1	A. L. McNaughton.
60°00 E.- " 24.....	47	23	5	" 5, '12	27 55.1	"
10°00 N.-SE " 19.....	47	23	5	Oct. 2, '12	28 07.8	"
13°00 S.-NE " 8.....	47	23	5	" 23, '12	08.1	"
6°00 N.-SE " 6.....	47	23	5	" 28, '12	27 57.1	"
35°00 N.- " 4.....	47	23	5	" 29, '12	28 02.0	"
10°00 S.-NE " 24.....	48	23	5	Aug. 20, '12	27 58.3	"
28°58 S.- " 20.....	85	23	5	Nov. 21, '13	31 28.8	L. E. Fontaine.

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I. — DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
12.32 S.-NE. cor. sec. 81.....	86	23	5	Nov. 23, '13	27.8	L. E. Fontaine.
37.00 S.-" 25.....	46	24	5	" 2, '13	27 57.2	A. L. McNaughton.
15.09 N.-" 24.....	86	24	5	" 26, '13	31 21.2	L. E. Fontaine.
21.75 S.-" 20.....	87	24	5	Dec. 3, '13	42.6	"
26.43 N.-" 23.....	86	25	5	Nov. 29, '13	23.8	"
7.00 E.-" 22.....	50	27	5	July 17, '12	27 47.2	C. A. Grassie.
21.40 N.-" 23.....	50	27	5	" 18, '12	50.8	"
7.37 N.-NE cor. sec. 26.....	50	27	5	July 19, '12	27°53.6	"
52.00 N.-" 22.....	50	27	5	" 28, '12	53.0	"
15.30 N.-" 27.....	50	27	5	" 31, '12	47.9	"
31.50 N.-" 34.....	48	28	5	Aug. 2, '12	29.0	"
39.80 N.-" 3.....	49	28	5	" 3, '12	27.9	"
30.00 E.-" 33.....	47	1	6	Sept. 6, '12	30.3	"
39.50 N.-" 6.....	47	1	6	" 20, '12	23.6	"
10.00 N.-SE " 6.....	47	1	6	" 21, '12	26.2	"
31.62 E.-NE " 23.....	48	1	6	Aug. 30, '12	24.4	"
45.00 N.-" 3.....	48	1	6	Sept. 5, '12	30.7	"
2.00 W.-" 24.....	49	1	6	Aug. 22, '12	37.0	"
70.00 W.-" 17.....	23	22	6	Sept. 5, '13	25 49.3	N. C. Stewart.
19.00 S.-" 18.....	23	2	6	" 6, '13	43.1	"
62.00 S.-" 18.....	23	2	6	" 8, '13	27.3	"
5.00 S.-" 7.....	23	2	6	" 10, '13	30.5	"
35.00 S.-" 7.....	23	2	6	" 10, '13	39.7	"
26.00 E.-" 6.....	23	2	6	" 15, '13	53.5	"
44.00 E.-" 6.....	23	2	6	" 16, '13	29.6	"
79.00 E.-" 7.....	23	2	6	" 19, '13	00.2	"
26.00 W.-" 15.....	23	3	6	" 30, '13	26 08.2	"
16.00 W. centre sec. 23.....	23	3	6	Oct. 4, '13	12.0	"
At NE cor. sec. 7.....	23	3	6	" 9, '13	01.0	"
47.00 S.-" 7.....	23	3	6	" 14, '13	25 31.3	"
23.00 W.-" 6.....	23	3	6	" 15, '13	44.2	"
At " 6.....	45	3	6	" 9, '12	27 30.9	C. A. Grassie.
64.07 N.-" 9.....	45	3	6	" 12, '12	26.3	"
3.85 E.-" 9.....	45	3	6	" 14, '12	29.7	"
42.10 E.-" 7.....	45	3	6	" 22, '12	31.8	"
At " 7.....	45	3	6	" 23, '12	39.1	"
47.00 W.-" 1.....	23	4	6	" 18, '13	26 00.4	N. C. Stewart.
16.00 W.-" 2.....	23	4	6	" 20, '13	25 23.0	"
4.00 W.-" 3.....	23	4	6	" 23, '13	53.8	"
53.00 S.-" 17.....	23	4	6	" 25, '13	41.4	"
43.00 N.-" 17.....	23	4	6	" 29, '13	25 43.3	"
9.00 W.-" 17.....	23	4	6	" 28, '13	46.3	"
73.00 W.-" 17.....	23	4	6	" 29, '13	43.2	"
40.00 W.-" 20.....	23	4	6	" 30, '13	37.0	"
43.00 W.-" 18.....	23	4	6	" 30, '13	39.9	"
32.00 W.-" 19.....	23	4	6	" 31, '13	34.6	"
18.27 N.-" 19.....	70	4	6	" 7, '13	28 24.8	L. E. Fontaine.
30.00 S.-" 24.....	23	5	6	" 31, '13	25 31.6	N. C. Stewart.
63.00 W.-" 24.....	23	5	6	Nov. 3, '13	40.5	"
53.00 S.-" 23.....	23	5	6	" 8, '13	39.3	"
3.00 W.-" 29.....	23	5	6	" 11, '13	55.1	"
50.00 W.-" 29.....	23	5	6	" 12, '13	26 04.0	"
11.00 W.-" 30.....	23	5	6	" 13, '13	00.0	"
34.60 S.-" 15.....	70	5	6	Oct. 2, '13	28 54.4	L. E. Fontaine.
24.63 N.-" 11.....	85	5	8	Nov. 1, '13	29 45.5	"
20.00 W.-" 23.....	23	6	6	" 17, '13	25 47.9	N. C. Stewart.
5.00 N.-" 24.....	70	6	6	Sept. 29, '13	29 12.1	L. E. Fontaine.
67.35 E.-SE " 4.....	79	6	6	Aug. 28, '13	30 25.4	"
25.70 S.-NE " 36.....	85	6	6	Nov. 5, '13	12.7	"
0.83 N.-" 36.....	79	7	6	July 29, '13	32 15.8	"
16.90 S.-" 36.....	80	7	6	" 18, '13	31 13.8	"
15.68 N.-" 36.....	85	7	6	Nov. 6, '13	30 47.9	"
57.49 S.-" 10.....	87	7	6	" 12, '13	38.0	"
77.00 N.-SE " 12.....	18	8	6	" 26, '13	25 36.8	N. C. Stewart.

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Continued.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
20°00 E.-NE. cor. sec. 33	20	25	6	Sept. 9, '13.	25 57.6	C. H. Taggart.
At " " 7	20	25	6	Oct. 31, '13.	54.8	"
40°00 W.- $\frac{1}{4}$ sec. cor. E. by sec. 35	21	25	6	Aug. 15, '13.	27 13.7	"
40°00 S.-NE. cor. sec. 22	21	25	6	" 19, '13.	26 56.0	"
40°00 E.- " 10	21	25	6	" 21, '13.	44.2	"
40°00 S.- " 10	21	25	6	" 22, '13.	25 55.8	"
20°00 W.- $\frac{1}{4}$ sec. cor. E. by sec. 33	21	25	6	Sept. 3, '13.	26 55.8	"
At NE cor. sec. 22	21	25	6	Sept. 4, '13	27 45.0	C. H. Taggart.
20°00 S.- " 17	21	25	6	" 17, '13	26 36.4	"
40°00 E.- " 31	21	25	6	" 22, '13	21.5	"
20°00 E.- " 31	21	25	6	" 22, '13	07.5	"
15°00 N.-NW " 6	21	25	6	" 30, '13	38.2	"
40°41 W.-NE " 2	5	26	6	June 4, '13	25 13.5	W. J. Johnston.
At " 3	5	26	6	" 5, '13	24 55.4	"
20°00 E.- " 3	5	26	6	" 7, '13	25 18.4	"
At SE cor. Lot. 2	5	26	6	" 10, '13	26.4	"
40°00 S.-NE cor. sec. 22	5	26	6	" 13, '13	37.5	"
67°00 S.- " 22	5	26	6	" 16, '13	31.2	"
45°00 N.- " 22	55	26	6	" 18, '13	41.4	"
22°00 S.- " 27	5	26	6	" 19, '13	30.9	"
45°00 W.- " 27	5	26	6	" 20, '13	45.7	"
53°00 W.- " 27	5	26	6	" 21, '13	31.6	"
49°40 N.- " 27	5	26	6	" 23, '13	24.8	"
35°49 W.- " 34	5	26	6	July 7, '13	26 13.4	"
10°00 W.-NE cor. Lot 873 sec. 34	5	26	6	" 11, '13	24 54.7	"
At NE cor. sec. 28	5	26	6	Aug. 11, '13	25 38.5	"
At NW cor. of Yale I. R. 8	6	26	6	" 9, '13	23.9	"
At NE cor. sec. 21	6	26	6	" 13, '13	34.7	"
20°50 N.- " 21	6	26	6	" 15, '13	26 14.1	"
35°00 E.-NW cor SW $\frac{1}{4}$ sec. 27	6	26	6	" 16, '13	25 46.9	"
25°00 W.-NE cor. sec. 16	6	26	6	" 19, '13	26 14.0	"
70°00 S.- " 3	6	26	6	June 24, '13	25 47.6	"
26°10 S.- " 3	6	26	6	" 25, '13	51.5	"
18°00 N.- " 3	6	26	6	" 30, '13	44.4	"
40°00 N.- " 3	6	26	6	July 2, '13	35.2	"
At " 10	6	26	6	" 3, '13	27.6	"
40°25 N.- " 10	6	26	6	" 4, '13	36.6	"
40°00 N.- " 15	6	26	6	" 15, '13	14.9	"
35°00 S.- " 27	6	26	6	" 17, '13	48.9	"
40°00 N.- " 27	6	26	6	July 19, '13	25 15.8	"
40°40 E.- " 3	6	26	6	" 24, '13	14.2	"
20°00 W.- " 3	6	26	6	" 28, '13	17.0	"
8°60 W.- " 3	6	26	6	" 29, '13	11.1	"
At SE cor. of Yale I. R. No. 11, sec. 3	6	26	6	" 31, '13	24.6	"
At NE cor. sec. 9	6	26	6	Aug. 2, '13	30.2	"
At " 4	6	26	6	" 4, '13	25.2	"
40°00 S.-NW cor. of Yale I. R. No. 11	6	26	6	" 6, '13	38.2	"
At SE cor. sec. 3	7	26	6	" 22, '13	26 04.9	"
22°00 N.-NE cor. NW $\frac{1}{4}$ sec. 3	7	26	6	" 26, '13	13.0	"
30°00 S.-NW cor. Lot 48	7	26	6	" 27, '13	23.4	"
5°00 E.-SW " 48	7	26	6	" 28, '13	28.8	"
25°00 W.-NE cor. sec. 14	7	26	6	" 30, '13	38.3	"
65°00 S.- " 35	7	26	6	Sept. 5, '13	30.2	"
36°10 S.- " 26	7	26	6	" 6, '13	31.0	"
40°25 S.-NE cor. NW $\frac{1}{4}$ sec. 24	7	26	6	" 10, '13	31.4	"
40°61 W.-NE cor. sec. 13	7	26	6	" 11, '13	41.5	"
14°00 W.- " 13	7	26	6	" 15, '13	25.9	"
38°00 W.- " 36	7	26	6	" 17, '13	35.0	"
20°12 S.- " 2	7	26	6	" 20, '13	32.1	"
10°00 N.- " 11	7	26	6	" 23, '13	34.0	"
63°00 E.-SW cor. of Yale I. R. No. 3	7	26	6	" 27, '13	40.5	"
At NE cor. NW $\frac{1}{4}$ sec. 14	7	26	6	Oct. 2, '13	44.4	"
39°00 N.-NE cor. sec. 1	8	26	6	June 10, '13	25 32.1	A. E. Hunter.
45°00 E.- " 11	8	26	6	" 14, '13	33.9	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.

TABLE I.—DECLINATION OBSERVATIONS—Continued.

Place.	Township.	Range.	Meridan.	Date.	Declination.	Observer.
50°00 S.-NE. cor. sec. 1	8	26	6	June 15, '13	24 51.2	A. E. Hunter.
20°00 W.-" 13	8	26	6	" 17, '13	25 59.0	"
48°00 E.-" 26	8	26	6	July 1, '13	31.1	"
54°30 N.-" 25	8	26	6	" 4, '13	26 15.7	"
67°20 N.-" 35	8	26	6	" 10, '13	21.5	"
20°00 W.-" 35	8	26	6	Aug 9, '13	18.1	"
65°00 W.-NE cor. sec. 35	8	26	6	Aug. 11, '13	26 13.9	"
23°56 N.-" 2	9	26	6	July 11, '13	21.9	"
56°00 N.-" 2	9	26	6	" 12, '13	10.4	"
75°00 N.-" 2	9	26	6	" 14, '13	16.3	"
10°00 N.-" 14	9	26	6	" 17, '13	35.3	"
50°00 N.-" 14	9	26	6	" 18, '13	49.7	"
20°00 N.-" 3	9	26	6	Aug. 15, '13	02.6	"
40°00 N.-" 3	9	26	6	" 16, '13	00.0	"
63°00 N.-" 3	9	26	6	" 19, '13	09.9	"
33°00 N.-" 10	9	26	6	" 20, '13	07.9	"
41°00 N.-" 15	9	26	6	" 23, '13	12.3	"
15°00 N.-" 21	9	26	6	Sept. 11, '13	07.0	"
36°00 N.-" 21	9	26	6	" 12, '13	04.0	"
At Sta. 9	9	26	6	" 15, '13	07.8	"
17°20 E.-" 28	9	26	6	" 16, '13	05.4	"
77°00 N.-" 22	9	26	6	" 25, '13	14.1	"
48°00 N.-" 22	9	26	6	" 26, '13	14.6	"
31°00 N.-" 27	9	26	6	" 27, '13	20.0	"
63°00 N.-" 27	9	26	6	" 29, '13	25.2	"
10°00 N.-" 34	9	26	6	" 30, '13	23.8	"
3°50 W.-" 34	9	26	6	Oct. 1, '13	31.4	"
68°00 N.-" 34	9	26	6	" 2, '13	23.6	"
30°00 N.-" 33	9	26	6	" 11, '13	07.8	"
20°00 N.-" 3	10	26	6	" 3, '13	23.6	"
46°00 N.-" 3	10	26	6	" 4, '13	25.0	"
35°00 W.-" 3	10	26	6	" 7, '13	21.2	"
34°00 N.-" 4	10	26	6	" 15, '13	04.6	"
27°00 E.-" 9	10	26	6	" 17, '13	14.2	"
70°00 E.-" 9	10	26	6	" 18, '13	21.9	"
43°00 N.-" 10	10	26	6	" 20, '13	18.2	"
36°00 W.-" 4	10	26	6	" 30, '13	25 54.4	"
40°00 E.-" 10	10	26	6	Nov. 1, '13	21.0	"
10°00 S.-" 7	12	26	6	Oct. 25, '13	46.2	A. V. Chase.
35°00 E.-NW " 31	12	26	6	Nov. 8, '13	55.8	"
30°00 S.-NE " 19	12	26	6	" 13, '13	26 20.6	"
At Sta. 9 traverse Left bank of Fraser R	12	26	6	" 18, '13	25 20.6	"
13°00 N.-SE cor. sec. 5	12	26	6	" 20, '13	25 55.0	"
14°50 W.-Wit. P.N. By. Boothroyd						
I.R. No. 8	13	26	6	Aug. 13, '13	25 40.7	"
44°00 N.-SE cor. sec. 6	15	26	6	Dec. 12, '13	27 13.0	J.A. Calder.
At NE " 31	19	26	6	Nov. 6, '13	25 45.4	C. H. Taggart.
20°00 S.-" 17	20	26	6	Oct. 28, '13	26 11.5	"
At " 19	20	26	6	Nov. 1, '13	08.6	"
5°00 S.-" 8	20	26	6	" 8, '13	09.4	"
50°00 S.-" 7	21	26	6	Oct. 16, '13	18.7	"
13°00 S.-" 29	4	27	6	" 17, '13	24 43.5	W. J. Johnston.
14°00 W.-" 20	4	27	6	" 20, '13	38.7	"
67°00 S.-" 19	4	27	6	" 21, '13	47.2	"
37°00 S.-" 2	5	27	6	June 28, '13	25 07.3	"
30°00 E.-" 15	12	27	6	Sept. 5, '13	23 40.8	A. V. Chase.
At Sta. 60, traverse of N. river.	12	27	6	" 9, '13	25 32.2	"
4°00 W.-NE cor. sec. 15	12	27	6	" 10, '13	41.2	"
60°00 W.-" 15	12	27	6	" 12, '13	33.2	"
At Sta. S. 10 traverse S. side of Lake						
Francis	12	27	6	" 22, '13	36.8	"
44°00 W.-NE cor. sec. 36	13	27	6	July 4, '13	26 15.4	"
40°25 S.-" 13	13	27	6	" 14, '13	25 40.1	"
32°00 N.-" 26	13	27	6	" 21, '13	26 19.5	"

SESSIONAL PAPER No. 25b

RESULTS OF MAGNETIC OBSERVATIONS—*Continued.*TABLE I.—DECLINATION OBSERVATIONS—*Concluded.*

Place.	Township.	Range.	Meridian.	Date.	Declination.	Observer.
15°00 N.-SE " 1.....	13	27	6	Aug. 16, '13	25 37.7	A. V. Chase.
At NE " 1.....	13	27	6	" 20, '13	19.4	"
At $\frac{1}{4}$ cor. N. by. sec. 1.....	13	27	6	Nov. 3, '13	36.5	"
15°00 N.- $\frac{1}{4}$ cor. N. by. sec. 12.....	13	27	6	" 5, '13	22.8	"
At Centre sec. 25.....	14	27	6	May 30, '13	50.7	"
At " 12.....	14	27	6	June 10, '13	26 13.7	"
50°00 N.-NE cor. sec. 27.....	14	27	6	" 19, '13	21.0	"
At " 22.....	14	27	6	" 21, '13	02.9	"
60°00 N.- " 22.....	14	27	6	" 17, '13	25 02.8	"
56°00 E.- " 15.....	14	27	6	Dec. 1, '13	26 27.0	"
At $\frac{1}{4}$ cor. N. By. sec. 35.....	14	27	6	" 3, '13	24.5	"
40°00 W.-NE cor. Lytton I.R. No. 3...	16	27	6	Oct. 1, '13	27 09.3	J. A. Calder.
40°00 W.- " ".....	16	27	6	" 1, '13	09.4	"
40°00 W.- " ".....	16	27	6	" 1, '13	12.0	"
40°00 E.- " ".....	16	27	6	" 1, '13	13.6	"
40°00 W.- " ".....	16	27	6	" 1, '13	18.4	"
40°00 W.- " ".....	16	27	6	" 1, '13	13.3	"
40°00 E.- " ".....	16	27	6	" 1, '13	09.0	"
40°00 W.- " ".....	16	27	6	" 1, '13	06.8	"
40°00 W.- " ".....	16	27	6	" 1, '13	07.1	"
42°00 S.- cor. sec. 6.....	17	27	6	" 17, '13	26 35.9	"
4°00 E.-NW " 7.....	17	27	6	" 29, '13	06.0	"
1°00 S.-NE " 5.....	18	27	6	Nov. 14, '13	35.0	"
4°00 W.- " 26.....	20	27	6	Oct. 20, '13	25 07.7	C. H. Taggart.
53°00 S.- " 27.....	20	27	6	" 21, '13	26 33.3	"
10°00 N.- " 15.....	20	27	6	" 22, '13	23 31.2	"
20°00 W.-SE " 32.....	1	28	6	Sept. 30, '13	25 17.0	R. B. McKay.
10°00 W.-NE " 2.....	4	28	6	Oct. 22, '13	24 57.2	W. J. Johnston.
20°00 S.- " 11.....	4	28	6	" 25, '13	50.8	"
44°45 W.- " 12.....	4	28	6	" 29, '13	57.2	"
10°00 W.- " 13.....	12	28	6	Sept. 25, '13	25 33.8	A. V. Chase.
20°00 E.- " 14.....	12	28	6	" 26, '13	38.0	"
At $\frac{1}{4}$ sec. cor. N. by. sec. 14.....	12	28	6	" 27, '13	35.1	"
At Sta. 103, N. of Nahatlatch lake...	12	28	6	Oct. 19, '13	16.8	"
19°00 E.-Centre of sec. 9.....	12	28	6	" 20, '13	19.4	"
20°00 W.- " 10.....	12	28	6	" 20, '13	44.7	"
10°00 N.- " 10.....	12	28	6	" 21, '13	48.3	"
24°70 N.- $\frac{1}{4}$ sec. cor. N. by. sec. 12.....	17	28	6	Nov. 3, '13	25 46.6	J. A. Calder.
40°40 E.-NE cor. sec. 11.....	18	28	6	Dec. 8, '13	27 49.5	"
31°00 E.- " 14.....	18	28	6	" 8, '13	28 50.3	"
20°00 S.- $\frac{1}{4}$ sec. cor. E. by. sec. 33.....	1	29	6	Sept. 26, '13	24 31.6	R. B. McKay.
At NE cor. Lot 20, Gr. 2.....	12	"	E.C.M.	Oct. 28, '12	25 55.4	A. Lighthall.
At NW cor. Langley Townsite.....	12	"	"	" 30, '12	26.4	"
At $\frac{1}{4}$ cor. S. by. sec. 1.....	19	"	"	Aug. 22, '13	23 24.5	R. B. McKay.
5°00 E.- $\frac{1}{4}$ cor. W. by. sec. 12.....	19	"	"	Oct. 16, '13	25 45.5	"
7°00 E.-NW cor. sec. 19.....	21	"	"	June 17, '13	32.1	"
1°00 N.- $\frac{1}{4}$ cor S. by. sec. 7.....	22	"	"	Aug. 22, '13	23 18.1	"
7°00 S.- $\frac{1}{4}$ cor E. by. sec. 35.....	22	"	"	Sept. 19, '13	43.6	"
At $\frac{1}{4}$ cor. S. by. sec. 29.....	22	"	"	Oct. 5, '13	43.5	"
52°00 S.-NE cor. sec. 27.....	23	"	"	" 29, '13	35.2	"
11°00 W.- " T.B. 86, in sec. 14.....	39	"	W.C.M.	July 3, '13	24 48.6	"
At NE cor. sec. 11.....	39	"	"	" 8, '13	36.5	"
6°00 S.- $\frac{1}{4}$ cor. E. by. sec. 11.....	39	"	"	" 5, '13	49.1	"
60°00 S.-NE cor. sec. 20.....	39	"	"	" 28, '13	34.9	"

RESULTS OF MAGNETIC OBSERVATIONS—Continued.
TABLE II.—INCLINATION AND TOTAL INTENSITY.

STATION.	Tp.	Rge.	Mer.	Date.	INCLINATION.		TOTAL INTENSITY.		Observer.	Instrument.
					L. M. T.	Value.	L. M. T.	Value. c.g.s.		
Distance in Chains from Nearest Post.										
37°00 W., 25°00 N.—NE cor. 1 sec. 23.	29	19	Pr.	Nov. 17, '13	h 14°1—15°1	79 12.16	h 14°5—14°8	0 63537	R. C. Purser....	T. S. 62.
" " " " 23.	29	19	Pr.	" 17, '13	14°8—15°8	12.8	15°1—15°4	0 63543	"	" "
" " " " 23.	29	19	Pr.	" 17, '13	15°4—16°3	12.8	15°8—16°1	0 63540	"	" "
30°00 NE.—NE cor. sec. 5	18	20	Pr.	June 16, '13	9°8—11°7	78 01.0	10°4—11°0	0 63334	G. A. Bennett..	T. S. 61.
30°00 NE.—" " 5.	18	20	Pr.	" 16, '13	11°1—13°3	01.4	11°7—12°3	0 63138	"	" "
" " " " 5.	18	20	Pr.	" 16, '13	12°7—14°4	00.6	13°3—13°9	0 63176	Blair Gray.....	" "
" " " " 5.	18	20	Pr.	" 16, '13	13°9—15°6	77 59.9	14°4—15°0	0 63213	"	" "
12°00 S.—NE cor. sec. 8.	18	21	Pr.	" 17, '13	15°6—17°2	78 09.1	16°2—16°7	0 63825	"	" "
" " " " 8.	18	21	Pr.	" 17, '13	16°8—18°8	08.1	17°6—18°2	0 63753	G. A. Bennett..	" "
30°00 S.—" " 8.	18	21	Pr.	" 23, '13	8°4—10°5	07.8	9°3—9°9	0 63682	Blair Gray.....	" "
" " " " 8.	18	21	Pr.	" 23, '13	10°0—11°9	08.0	10°6—11°1	0 63779	"	" "
" " " " 8.	18	21	Pr.	" 23, '13	11°3—13°5	07.8	12°1—12°7	0 63734	G. A. Bennett..	" S. 62.
15°00 E.—" " 6.	33	31	Pr.	" 20, '13	15°4—16°6	32.7	15°9—16°3	0 63687	E. J. Wight ..	" "
" " " " 6.	33	31	Pr.	" 20, '13	16°3—17°4	33.4	16°6—16°9	0 63765	"	" S. 61.
20°00 S.—" " 28.	19	1	2	" 7, '13	14°1—16°0	77 41.7	14°7—15°4	0 63065	Blair Gray.....	" "
" " " " 28.	19	1	2	" 7, '13	15°6—17°9	44.3	16°2—17°0	0 63154	G. A. Bennett..	" "
" " " " 28.	19	1	2	" 7, '13	17°1—19°4	46.0	18°0—18°9	0 63048	"	" "
" " " " 28.	19	1	2	" 7, '13	19°0—20°7	43.2	19°5—20°1	0 63026	Blair Gray....	" "
15°00 S.—" " 28.	19	1	2	" 9, '13	8°5—10°2	41.0	9°1—9°6	0 63140	"	" "
2°00 NE.— $\frac{1}{4}$ M.N. by. sec. 23.	19	8	2	Nov. 3, '13	9°9—10°9	31.9			G. A. Bennett..	" "
12°00 N.— $\frac{1}{4}$ " " 11	7	10	2	July 14, '13	7°3—9°6	76 34.9	8°3—8°9	0 62741	Blair Gray.....	" "
12°00 N.— $\frac{1}{4}$ " " 11	7	10	2	" 14, '13	9°1—11°2	36.1	9°8—10°5	0 62581	G. A. Bennett..	" S. 62.
9°00 SE.— $\frac{1}{4}$ P.E. by. sec. 21.	26	11	2	June 16, '13	8°8—10°3	77 52.2	9°5—9°8	0 62833	E. J. Wight....	" "
" " " " 21.	26	11	2	" 16, '13	9°8—11°1	51.6	10°3—10°8	0 62755	"	" "
10°00 S., 25°00 W.—NE cor. sec. 27.	33	11	2	Dec. 13, '13	13°8—14°6	78 14.9	14°0—14°3	0 62832	"	" "
" " " " 27.	33	11	2	" 13, '13	14°3—15°2	15.1	14°6—14°9	0 62828	"	" "
" " " " 27.	33	11	2	" 13, '13	14°9—15°8	15.1	15°2—15°5	0 62825	"	" S. 61.
20°00 W.—NE cor. sec. 13.	18	13	2	July 25, '13	14°1—16°1	77 04.0	14°9—15°5	0 62961	Blair Gray....	" "
8°00 S., 30°00 W.—NE cor. sec. 12.	18	13	2	" 25, '13	15°6—17°2	04.8	16°1—16°6	0 62938	"	" S. 62.
" " " " 12.	33	13	2	Aug. 26, '13	13°2—14°2	78 11.8	13°6—13°9	0 62807	E. J. Wight....	" "
36°00 S., 30°00 E.—NW cor. sec. 31.	33	13	2	" 26, '13	13°9—14°7	11.6	14°2—14°5	0 62810	"	" "
" " " " 12.	33	13	2	" 26, '13	14°5—15°3	11.6	14°7—15°1	0 62816	"	" "
1°00 SE.— $\frac{1}{4}$ I.P. centre sec. 22.	47	14	2	July 27, '13	10°3—11°2	79 00.0	10°7—11°0	0 63177	"	" "
8°00 N., 8°00 W.—SE cor. sec. 15.	42	16	2	" 27, '13	11°0—11°8	00.6	11°2—11°6	0 63180	"	" "
" " " " 15.	25	27	2	June 7, '13	14°3—16°2	78 35.9	15°1—15°7	0 62891	"	" "
" " " " 15.	25	27	2	July 5, '13	7°4—8°4	77 04.7	7°8—8°1	0 62809	"	" "

SESSIONAL PAPER No. 25b

45°00' N., 8°00' W.—SE cor. sec. 15.	25	27		July	5, '13.	8.1—8.8	05.2	8.1	8.7	E. J. Wight . . .	T. S. 62.
" " " " " " " " " " " "	25	27		"	5, '13.	8.7—9.1	05.3	8.8	9.1	"	"
25°00' W., 15°00' S.—NE cor. sec. 21.	33	28		Sept.	1, '13.	8.3—9.3	77.34.1	8.8	9.1	"	"
" " " " " " " " " " " "	33	28		"	1, '13.	9.1—9.9	33.8	9.3	9.7	"	"
25°00' W., 15°00' S.—NE cor. sec. 21.	33	28		Sept.	1, '13.	9.7—10.5	77.33.5	9.9	10.3	"	"
40°00' E.—NE cor. sec. 21.	17	1		May	23, '13.	16.3—20.2	02.9	18.7	19.3	G. A. Bennett	T. S. 61.
30°00' E.—NE " 21.	17	1		July	7, '13.	15.3—17.4	76.58.3	16.2	16.7	Blair Gray . . .	"
20°00' N.—NE " 35.	15	2		June	30, '13.	14.8—16.8	46.3	15.7	16.3	"	"
20°00' N.—NE " 35.	15	2		"	30, '13.	16.4—18.3	44.7	17.0	17.7	"	"
30°00' N.—NE " 35.	15	2		July	1, '13.	8.3—10.2	46.3	9.0	9.5	"	"
30°00' N.—NE " 35.	15	2		"	1, '13.	9.7—11.4	45.9	10.3	10.8	"	"
30°00' N.—NE " 9.	30	3		June	2, '13.	10.9—12.4	77.14.1	11.3	11.9	E. J. Wight . . .	T. S. 62.
At NE " 9.	30	3		"	2, '13.	12.0—13.8	13.5	12.9	13.4	"	"
15°00' E.—20°00' S.—NW cor. sec. 9.	37	5		Aug.	14, '13.	14.9—15.9	37.2	15.3	15.7	"	"
15°00' E.—20°00' S.—NW cor. sec. 9.	37	5		"	14, '13.	15.6—16.5	37.1	15.9	16.2	"	"
15°00' E.—20°00' S.—NW cor. sec. 9.	37	5		"	14, '13.	16.2—17.1	37.0	16.7	16.8	"	"
43°00' E.—NE cor. sec. 14.	25	6		Nov.	21, '13.	13.6—14.5	76.55.6	14.3	14.9	Blair Gray . . .	T. S. 61.
43°00' E.—NE " 14.	25	6		"	22, '13.	13.1—15.7	57.5	13.8	14.6	G. A. Bennett	"
20°00' W.—NE " 9.	42	6		June	27, '13.	13.7—14.7	78.07.8	14.1	14.5	E. J. Wight . . .	F. S. 62.
12°00' E.—1 sec. cor. N. by sec. 9.	42	6		"	27, '13.	9.7—11.7	16.5	10.4	10.9	R. C. Purser	"
5°00' N.—3°00' W.—SE cor. sec. 21.	53	7		Nov.	4, '13.	3.5—10.5	59.4	9.9	10.3	E. J. Wight . . .	"
5°00' N.—3°00' W.—SE " 21.	53	7		"	4, '13.	10.3—11.1	59.1	10.5	10.9	"	"
5°00' N.—3°00' W.—SE " 21.	53	7		"	4, '13.	10.9—11.8	59.0	11.1	11.4	"	"
15°00' W.—NE cor. sec. 13.	15	14		Oct.	16, '13.	14.7—16.3	76.15.1	15.2	15.7	Blair Gray . . .	T. S. 61.
15°00' W.—NE " 13.	15	14		May	20, '13.	9.8—11.8	14.9	10.7	11.3	"	"
6°50' N.—4°50' E.—NE cor. sec. 2.	30	15		"	28, '13.	8.8—10.9	77.01.3	9.6	10.2	E. J. Wight . . .	T. S. 62.
6°50' N.—4°50' E.—NE " 2.	30	15		"	28, '13.	10.2—12.1	01.4	10.9	11.6	"	"
15°00' N.—NE cor. sec. 25.	17	16		Oct.	17, '13.	11.4—12.9	76.24.4	12.0	12.4	Blair Gray . . .	T. S. 61.
10°00' W.—NE " 17.	19	18		May	22, '13.	8.8—11.3	32.2	9.7	10.6	"	"
2°00' S.—NE " 28.	39	19		July	19, '13.	15.0—15.9	77.34.2	15.3	15.7	E. J. Wight . . .	T. S. 62.
2°00' S.—NE " 28.	39	19		"	19, '13.	15.7—16.6	33.5	15.9	16.3	"	"
18°00' E.—P. W. by sec. 16.	45	23		"	9, '13.	14.5—15.5	49.8	14.8	15.1	"	"
18°00' E.—P. W. by sec. 16.	45	23		"	9, '13.	15.1—16.1	50.1	15.5	15.8	"	"
55°00' S.—NE cor. sec. 17.	50	23		Aug.	12, '13.	13.4—14.3	78.07.9	13.7	14.0	"	"
55°00' S.—NE " 17.	50	23		"	12, '13.	14.0—14.9	07.9	14.3	14.7	"	"
15°00' N.—43°00' E.—SE cor. sec. 3.	51	27		July	4, '13.	7.6—8.6	03.4	7.9	8.3	"	"
25°00' S.—NE cor. sec. 23.	17	5		Sept.	20, '13.	13.1—15.0	75.39.1	13.9	14.4	Blair Gray . . .	T. S. 61.
25°00' S.—NE " 23.	17	5		"	20, '13.	14.5—17.4	39.8	15.1	15.7	"	"
25°00' S.—NE " 23.	17	5		"	20, '13.	16.8—17.4	42.2	15.8	16.6	G. A. Bennett	"
10°00' NW.—NE cor. sec. 36.	12	6		"	23, '13.	15.9—17.5	29.5	16.5	17.0	Blair Gray . . .	"
16°00' NW.—NE " 36.	12	6		"	9, '13.	14.9—15.9	31.6	"	"	G. A. Bennett	"
8°00' SE.—NE " 34.	18	10		Aug.	2, '13.	7.4—9.4	21.8	8.2	8.8	Blair Gray . . .	"
10°00' W.—28°00' N.—SE cor. sec. 19.	33	10		Sept.	7, '13.	6.6—7.6	76.24.2	7.0	7.3	E. J. Wight . . .	T. S. 62.
10°00' W.—28°00' N.—SE " 19.	33	10		"	7, '13.	7.3—8.2	24.8	7.6	7.9	"	"
10°00' W.—28°00' N.—SE " 19.	33	10		"	7, '13.	7.9—8.8	24.9	8.2	8.5	"	"
30°00' E.—NE cor. sec. 24.	15	11		Aug.	5, '13.	14.1—15.9	75.08.3	14.6	15.2	Blair Gray . . .	T. S. 61.
" " " " " " " " " " " "	15	11		"	"	15.3—17.3	08.2	16.1	16.8	"	"
10°00' W.—" " " " " " " " " " " "	17	13		July	28, '13.	9.1—10.9	24.2	9.7	10.3	"	"
" " " " " " " " " " " "	17	13		"	"	10.4—12.1	25.0	10.9	11.6	"	"

RESULTS OF MAGNETIC OBSERVATIONS.—*Concluded,*

TABLE II.—INCLINATION AND TOTAL INTENSITY.

STATION.		Tp.	Rge. Mer.	Date.	INCLINATION.		TOTAL INTENSITY.		Observer.	Instrument
					L. M. T.	Value.	L. M. T.	Value, c.g.s.		
Distance in Chains from Nearest Post.										
20.00 NW.-NE cor. sec. 10.....		9	16	4 Oct. 15, '13.	h 13.4 15.6	74 40.1	h 14.1 14.9	0 61450	G. A. Bennett..	T. S. 61.
" " " 10.....		9	16	" " " "	15.4 17.0	40 6	15 9 16.4	0 61468	Blair Gray.....	"
10.00 S.- " " 6.....		8	21	4 Sept. 8, '13.	10.7 12.3	33 0	11 2 11.7	0 61187	"	"
30.00 S., 15.00W.-NE cor. sec. 24.....		34	21	4 Oct. 23, '13.	13.5 15.2	76 09.1	14 2 14.7	0 61770	R. C. Purser....	T. S. 62.
30.00 SW.-NE cor. sec. 9.....		3	25	4 Aug. 16, '13.	14.6 16.3	74 22.1	15 3 15.7	0 61331	Blair Gray.....	T. S. 61.
" " " 9.....		3	25	" " " "	15.9 17.7	22 3	16 6 17.2	0 61315	G. A. Bennett.	"
35.00 S.- " " 11.....		2	29	4 Aug. 8, '13.	15.8 17.6	73 52.5	16 6 17.1	0 61438	Blair Gray.....	"
" " " 11.....		2	29	" " " "	17 2 18 9	52 2	17 9 18.5	0 61363	"	"
55.00 S.- " " 29.....		20	29	4 Sept. 24, '13.	14.4 16.2	75 13.3	15 1 15.7	0 61236	"	"
60.00S. SE-" " 29.....		20	29	4 Oct. 2, '13.	14.4 16.2	12 5	15 1 15.6	0 61176	G. A. Bennett..	"
5.00S W.-4M. E by. sec. 35.....		19	4	5 Sept. 25, '13.	15 0 16.7	74 55.6	15 7 16.2	0 61300	Blair Gray.	"

APPENDIX No. 59.

RESULTS OF WATCH TRIALS.

Name.	Number of Watch	Escapement, Balance spring, &c.	Mean daily variation of mean daily rate.								Diff. between m.d.r. and m. of m.d.r. at 65° F.					Mean Error.	M. ch. of r. for 1° F.	Total Marks 0-1000.		
			P.U. | P.R. | P.L. | D.U. | D.D. | P.U. | 65° | 90° | 65°								P.U. | P.R. | P.L. | D.U. | D.D. | P.U.									
			65°	65°	65°	40'	D.U.	65°	D.U.	65°	P.U.	P.R.	P.L.	D.U.	D.D.				P.U.	
Waltham Watch Co.	19001012	D r., g.b., l.e., s.o.	0.32	0.48	0.23	0.23	0.57	0.22	0.24	0.30	0.32	-0.18	-1.98	+0.58	+0.58	+0.52	+0.50	0.72	0.09	687.0
"	18091080	"	0.46	0.42	0.09	0.44	0.34	0.42	0.10	0.15	0.30	+0.21	-2.09	-2.17	+1.91	+1.27	+0.85	1.42	0.07	631.0
"	18028560	"	0.28	0.16	0.64	0.41	0.40	0.57	0.37	0.12	0.37	+2.67	-3.13	+2.17	-0.13	-1.37	-0.23	1.62	0.06	577.5
"	18091036	"	0.33	0.18	0.59	0.43	0.55	0.25	0.22	0.16	0.34	-2.08	-2.14	+0.84	+3.02	+1.10	-0.72	1.65	0.08	576.8
"	52	"	0.34	0.26	0.12	0.50	0.48	0.60	0.21	0.25	0.34	+2.67	-4.57	+0.35	-1.15	+0.31	+2.39	1.91	0.08	547.1
"	15	"	0.42	0.12	0.23	0.36	0.29	0.24	0.24	0.22	0.26	+3.67	-2.31	-1.85	-2.75	-0.11	+3.37	2.34	0.10	527.2
"	94	"	0.50	0.44	0.40	0.45	0.39	0.34	0.24	0.30	0.38	+2.35	-1.57	-2.07	+2.09	-1.27	+1.45	1.80	0.12	511.6
Hamilton Watch Co.	688005	"	0.18	0.49	0.15	0.63	0.36	0.46	0.22	0.34	0.35	-0.17	-5.37	+2.35	-2.11	+3.13	+2.17	2.55	0.03	501.9
Waltham Watch Co.	19001065	"	0.56	0.57	0.21	0.33	0.58	0.44	0.14	0.31	0.40	-1.78	-0.62	+3.98	+1.36	+0.54	-3.46	1.96	0.10	496.0
"	18091079	"	0.64	0.21	0.44	0.23	0.26	0.74	0.30	1.10	0.49	-0.07	+2.57	-4.67	+1.01	+1.81	-0.63	1.79	0.09	474.1
"	27	"	0.35	0.50	0.15	0.75	0.76	0.16	0.26	0.44	0.42	-1.86	+4.76	+1.26	-1.70	-2.28	-0.20	2.01	0.14	453.0
"	38	"	0.61	0.85	0.54	0.12	0.84	0.30	0.26	0.19	0.46	-2.04	-2.42	+1.64	+2.42	+1.60	-1.22	1.89	0.13	452.0
"	18091083	"	1.47	0.45	0.39	0.37	0.41	0.27	0.31	0.91	0.57	+0.90	-0.52	-5.52	+1.38	+3.46	+0.25	2.01	0.06	426.3
"	33	"	0.70	1.03	0.42	0.49	0.28	0.26	0.32	0.38	0.48	+3.58	-0.98	-4.78	+0.30	-0.90	+2.75	2.22	0.10	423.6
"	18028541	"	0.60	0.76	0.20	0.28	0.59	0.44	0.13	0.38	0.42	+4.43	+0.63	-1.47	+0.09	-6.93	+3.25	2.80	0.06	416.0
"	18091028	"	1.65	0.43	0.71	0.34	0.39	0.34	0.36	0.47	0.59	+1.01	+2.41	-4.07	+0.49	+1.65	-1.51	1.85	0.09	412.2
"	19001067	"	0.57	1.14	0.31	0.74	0.50	0.56	1.18	0.33	0.67	-1.35	-1.99	-1.21	+1.75	+3.49	-0.69	1.75	0.06	402.7
"	18091046	"	0.36	0.41	0.46	0.26	0.37	0.29	0.27	0.19	0.33	+1.30	-1.31	-0.48	-2.96	-1.18	-1.98	2.09	0.31	385.1
"	82	"	0.56	0.44	0.86	0.39	0.69	0.39	0.41	0.90	0.58	+1.86	-0.94	-2.22	+3.02	+1.70	-3.02	2.06	0.11	381.9
"	74	"	0.94	0.48	0.78	0.50	0.64	0.26	0.18	0.58	0.54	+1.46	-2.62	-3.54	+2.98	+0.96	+0.76	2.05	0.15	377.7
"	45	"	0.20	0.32	1.02	0.66	0.20	0.50	0.57	1.14	0.58	+4.30	-4.00	-2.48	-1.30	+3.44	+0.02	2.59	0.06	354.7
Hamilton Watch Co.	965620	"	0.64	0.84	0.32	0.40	0.28	0.44	0.41	1.16	0.56	-0.68	-7.38	+5.22	+1.32	+0.88	+0.62	2.68	0.14	301.7
Waltham Watch Co.	18091050	"	0.90	0.54	0.15	0.51	0.64	0.16	0.41	0.76	0.55	+2.70	-0.30	-5.96	-0.82	-1.98	+6.38	3.02	0.12	241.5

